"EVALUATION OF CLINICAL EFFECTIVENESS OF AUTOGENOUS DENTIN GRAFT IN SOCKET PRESERVATION – A CLINICAL AND RADIOGRAPHICAL STUDY"

A Dissertation submitted in
partial fulfillment of the requirements
for the degree of

MASTER OF DENTAL SURGERY

BRANCH – II

PERIODONTOLOGY

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI – 600 032

2016 – 2019

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Department : DEPARTMENT OF PERIODONTICS,
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ABSTRACT

BACKGROUND: Healing of the extracted socket commonly results in osseous deformities. One of the recent approaches in preserving the extracted socket is the use of autogenous dentine graft maerial. Autogenous dentine graft revolutionizes discarded biomedical waste into a novel bone graft material and eliminates the use of commercial bone graft material.

AIM: To evaluate the clinical and radiological effectiveness of autogenous dentin graft in preserving the extracted alveolar socket.

MATERIALS AND METHODS: A total number of 10 vital tooth indicated for extraction in 10 systemically healthy patients were selected randomly for the purpose of the study. After atraumatic extraction, the extracted sockets were treated with autogenous dentine graft prepared from the extracted tooth. Clinical parameters such as socket width and radiographic analysis CBCT were recorded at baseline and 6 months post-operatively.

RESULTS: The soft tissue ridge width, radiographic crest width ,width at 5mm 10mm from crest and socket height between pre-operative and post-operative analysis was statistically significant. (p=0.000, p=0.000, p=0.000, p=0.000, p=0.003).

CONCLUSION: Within the limits of present study, socket preservation using autogenous dentine graft offers many advantages for patients and the clinician. However, careful patient selection and treatment planning appears to be of critical importance in achieving a predictable outcome. Further randomized clinical trials are needed to monitoring soft tissue dynamics & hard tissue changes and histological observations are required to establish its regenerative potential in various field of application.

KEY WORDS: Socket preservation, autogenous dentine graft, alveolar ridge preservation.

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LIST OF ABBREVIATIONS

ABM	anorganic bovine bone matrix
ADDM	autogenous demineralized dentin matrix
AutoBT	autogenous tooth bone graft
BPCAP	biphasic alloplastic graft
BMP	bone morphogenic proteins
CD	Cluster differentiation
CGF	Concentrated growth factor
CBCT	Cone beam computed tomography
DDM	Demineralized dentin matrix
DFDBA	demineralized freeze-dried bone allograft
DPSC	dental pulp-derived, stem cells
EDTA	ethylenediamine tetra-acetic acid
FGF	Fibroblast growth factor
FDBA	freeze-dried bone allograft
GBR	Guided bone regeneration
GTR	guided tissue regeneration
HDDM	homogenous demineralized dentin matrix
HIV	human immunodeficiency virus

HA	Hydroxyapatite
IGF	Insulin-like growth factor
LC/MS	liquid chromatography/mass spectroscopy
PDL	Periodontal ligament
ePTFE	Polytetrafluoroethylene
rhBMP-2	recombinant bone morphogenetic protein-2
SEM	Scanning electron microscope
SDS-PAGE	sodium dodecyl sulphate-polyacrylamide gel electrophoresis
TGF	Transforming growth factor
TCP	tri calcium phosphate
VEGF	Vascular endothelial growth factor

INTRODUCTION

Tooth extraction is one of the routine outpatient procedure done universally as a treatment plan of hopeless tooth. After tooth extraction dimentional change in the alveolar ridge is inevitable. The remaining socket heals from the apex toward the crest. When no additives are placed into the socket at the time of the extraction, the soft tissue infiltration at the crest often results in facial and crestal bone loss. This bone resorption is more rapid in case of pre-existing periodontal disease, inflammatory periapical lesions or serious previous bone wall defects due to traumatic extraction.

The greatest amount of bone loss is in the horizontal dimension and occurs mainly on the facial aspect of the ridge. There is also loss of vertical ridge height, which has been described to be most pronounced on the buccal aspect **(Lekovic et al. 1997, 1998[1,2], Arau´jo & Lindhe 2005[3])**. This resoprtion process results in a narrower and shorter ridge **(Pinho et al. 2006[4])** and the effect of this resorptive pattern is the relocation of the ridge to a more palatal/lingual position.

Therefore preserving the alveolar dimension of the socket after extraction aid in successful accomplishment of future rehabilitation such as fixed partial denture, dental implants. Socket preservation is a surgical procedure in which graft material or a scaffold is placed in a fresh extraction socket to preserve the alveolar ridge for a future prosthesis.

Teeth and bones share many similarities. Teeth, cartilages, nerves, and maxillofacial bones all embryologically originated in the neural crest, sharing identical origin.

Based on the potentials of osteoconduction, osteoinduction, and osteogenesis through growth factors in tooth and similar histogenesis between tooth and bone, a novel bone graft material can be developed utilizing the inorganic and organic components of an extracted tooth.

Indeed, autogenous tooth bone graft material (AutoBT; Korea Tooth Bank Co., Seoul, Korea) has been developed from an extracted tooth. (**Su-Gwan Kim, Young-Kyun Kim, Jin-Sung Park 2011)**[5]

There are many techniques, like using autogenous, allogeneic, xenograft, and alloplast graft materials, to guide and assist specialized cellular components of the periodontium to participate in the regenerative process to preserve bone width and height of the alveolus.

This study aims to evaluate the efficacy of autogenous dentin graft material in achieving good bone fill, which is essential for preservation of alveolar ridge dimensions.

AIM AND OBJECTIVES

AIM

To evaluate the clinical and radiological effectiveness of autogenous dentin graft in preserving the extracted alveolar socket.

OBJECTIVES

To assess the effectiveness of autogenous dentin graft in preserving the extracted alveolar socket , using

1.Clinical parameters

Clinical evaluation by boley's gauge with stent.

2. Radiological parameters.

CBCT evaluation of socket width

CBCT evaluation of socket height

REVIEW OF LITERATURE

Reduction in the alveolar bone dimensions invariably occurs after tooth extraction. During socket healing period, new bone grows into the extraction site while the alveolar ridge is being resorbed. Several studies have demonstrated that the width and the height of th0e alveolar bone decreased significantly immediately after tooth extraction[3,6,7]. Dimensional loss of socket bone hinders dental implant placement and conventional prosthesis. Therefore, in order to maintain the alveolar ridge dimensions, it is essential to perform socket preservation procedures after tooth extraction, which can be performed by placing grafting materials in the extraction socket as a framework for bone deposition.

To maintain the alveolar ridge dimensions, different bone graft materials are employed for ridge preservation. Autologous bone graft is widely accepted as the standard in regenerative procedures because of its osteogenesis, osteoinduction and osteoconduction properties[8]. Despite these essential properties, drawbacks of the autologous bone grafting include a need for the second site surgery, donor site morbidity, and limited availability.

These drawbacks have led to the challenging study for alternative biomaterial scaffolds with osteoinductive potential. Generally, xenografts or allografts are utilized with good outcomes[9,10]. Nevertheless, the shortcomings of xenografts and allografts are that they lack osteogenic properties[11-13], tend to be expensive, and may increase the risk of disease transmission. Because of the mentioned problems, researchers have been constantly putting efforts to develop better bone substitute materials.

Healing of alveolar bone after tooth extraction

Osseous deformities of the alveolar ridge, including both width and height reduction of the residual ridge, are typically caused by tooth extraction and the following healing of the socket. Bone resorption will result in a reduction of socket height in an apico-coronal direction and socket width in a bucco-lingual direction. Healing of an extraction socket is characterized by internal changes that lead to formation of bone within the socket, and external changes that lead to loss of alveolar ridge width and height[14].

Internal changes

When a tooth is removed, there is haemorrhage followed by formation of a blood clot that fills the entire socket[15]. With this is an inflammatory reaction that stimulates recruitment of cells to form granulation tissue. Within 48 to 72 hours after extraction the clot starts to breakdown as granulation tissue begins to infiltrate the clot especially at the base of the socket. By four days the epithelium proliferates along the socket periphery and immature connective tissue is apparent.

After seven days the granulation tissue has completely infiltrated and replaced by the clot. At this stage, osteoid is evident at the base of the socket as uncalcified bony spicules. Over the next 2–3 weeks (3–4 weeks after extraction) this begins to mineralize from the base of the socket coronally. This is accompanied by continued re-epithelialization which completely covers the socket by six weeks post-extraction. Further infill of bone takes place with maximum radiographic density at around 100 days.

A number of factors may affect the healing of undisturbed sockets. The size of the socket is important with wider sockets requiring more time to bridge the defect

compared with narrower sockets; it takes longer period for bone formation at molar sites compared to single-rooted sites. The sockets of teeth with horizontal bone loss heal more quickly as the lower level of the alveolar bone means less infill is required. It should be noted that bone does not regenerate to a level coronal to the horizontal level of the bone crest or to the level of the neighbouring teeth (i.e., 100 per cent socket fill does not occur)[14].

External changes

A recent study by **Araujo and Lindhe**[3] showed that in the first eight weeks following extraction in a dog model there is marked osteoclastic activity resulting in the resorption of the buccal and lingual crestal walls. They noted that the reduction of the height was more pronounced at the buccal wall and was accompanied by a horizontal loss on both buccal and lingual walls. This is an important finding because an adequate width and height of buccal bone is important for optimal implant aesthetics, and this study suggests that loss of buccal bone may result in poorer, suboptimal aesthetics.

Dimensional changes following tooth extraction

Resorption of the external buccal and lingual socket walls results in a change in the dimensions of the ridge. Studies have shown that there exists a wide variation between subjects in the dimensional changes both clinically and radiographically following removal of teeth, characterized by very rapid reduction in both height and width.[16,17]

Pietrokovski(1975)[18] in an examination of healed sockets in dried skulls showed that, when viewed from the occlusal aspect, the crest of the residual ridge shifts lingually, and when viewed from the lateral aspect, the ridge formed a concavity

or flattened to form a wall running straight between the alveolar crests of the adjacent remaining teeth.

Studies by **Lekovic et al (1997,1998)**[1,2] have shown that there is greater loss of alveolar ridge width than height and that some degree of loss was observed at all extraction sites.

It has been suggested that this variability is due to anatomic, prosthetic, metabolic, functional, genetic and iatrogenic factors.[19] The most rapid changes were found in the early post-extraction period, from six months to two years.[20,21]

In addition, **Atwood and Coy (1991)** [21] showed that there were differences in the rate of resorption between maxillary and mandibular sites. They found that the average change was four times greater in the mandible than the maxilla. It should be noted that the above studies were performed on edentulous subjects.

Schropp et al (2003)[14] studied the effect of a single tooth extraction of premolar or molar teeth on bone healing and soft tissue changes using clinical and radiographic measurements as well as digital subtraction radiography. They showed that major changes take place in the 12 months following an extraction with an average of 50 per cent reduction in the width of the alveolar ridge. Two-thirds of this reduction occurred within the first three months. This loss averaged between 5 and 7 mm and was similar at all sites in the mouth. Importantly, most of the subjects did not wear a denture after extraction. Immediately after tooth extraction the width of the ridge was an average of 12 mm (8.6– 16.5 mm) and 12 months later 5.9 mm (2.7–12.2 mm).

In a recent systematic review, **Tan et al**[22] reported a higher resorption of ridge bone horizontally (29-63%; 3.79 mm) than vertically (11-22%; 1.24 mm) at month

six. Naturally, the process of alveolar ridge resorption slowly occurred throughout one's life at the rate of **0.5-1.0%** per year

Artzi et al (2016)[23] published a systematic review in which he stated that changes of alveolar bone dimension of extraction sockets in humans exhibited a range of 2.6-4.6 mm in width reduction, and showed a range in height reduction between 0.4-3.9 mm24. The rate of alveolar ridge resorption after tooth extraction was faster in the first nine months 2, 25. It was found that two-thirds of the resorption happened in the first three months, and half of the ridge width decreased in the first 12 months (average 6.1 mm; 2.7-12.2 mm).

Several components may impact the changes of bone dimensions after tooth extraction, for example the tooth position in the dental arch, the number and proximity of teeth to be extracted, the condition of the socket before and after extraction, and the tissue biotype. Thin biotype with highly scalloped hard and soft tissues is more prone to display hard tissue resorption and soft tissue recession than the thick biotype.

The severity of the healing pattern may establish a problem for the clinician such as an aesthetic problem in the manufacture of an implant-supported restoration, an orthodontic tooth movement into extraction site, etc. In order to eliminate or minimize extensive hard and soft tissue regenerative surgical procedures, socket preservation can be carried out at the time of tooth extraction.

Socket preservation is a procedure at the time of tooth extraction to control bone resorption. It aims to preserve the bone volume and soft tissue position of the alveolar ridge, to reduce post-extraction dimensional changes and to eliminate future bone regeneration that required for ideal implant placement[24].

Surgical techniques for socket preservation

Although tooth extraction is by necessity a traumatic procedure, the application of appropriate instruments with minimal force is recommended to limit damage to the hard and soft tissues. Fine luxators or periotomes can be inserted into the periodontal ligament to sever the coronal fibre attachment, thereby loosening the tooth until forceps can gently deliver the tooth from its socket. Multi-rooted teeth can be decoronated and the roots sectioned and extracted individually to facilitate this procedure. Given the increasing acceptance of implant therapy, it may be argued that all extractions should be undertaken with as minimally traumatic a technique as possible. Even if an implant is not planned at the time of tooth removal, the site may subsequently be considered for implant placement.

The principles behind the practice of implant site development, such as socket preservation/ridge preservation and guided bone regeneration, emerged from the principles of guided tissue regeneration. At the time of tooth extraction, the socket can be augmented by several techniques such as

- Preservation of socket using membrane or socket sealing materials
- Preservation of socket using bone or bone substitute grafts with/without membrane

Preservation of alveolar ridges using membrane or socket sealing materials

Guided bone regeneration (GBR) technique includes the use of barrier membrane to inhibit gingival cells from moving into bone defect area. Animal and clinical studies show that alveolar socket has a tendency to heal itself[25-28]. Bone formation from the bottom of tooth socket up to alveolar crest may be the result of the

existence of blood coagulum that developed into granulation tissue. Then, epithelial cells will creep along granulation tissue and seal the wound of the extraction site.

There are many types of barrier membranes that were used to seal the extraction site such as expanded polytetrafluoroethylene (ePTFE)[29],collagen membrane[30], polyglycolic acid[2],and polyglactin[2] etc. These are divided into two types, based on resorption properties, which are resorbable type and non-resorbable type.

Lekovic et al[1] used a non-absorbable ePTFE membrane to preserve alveolar ridge after tooth extraction for six months. They found that ridge dimensional change of the group with ePTFE membrane usage to be lower than that of the control group. However, when the membrane was exposed, ridge dimension changes were the same for both groups.

Further study by **Pinho et al**[4] on the usage of titanium membrane, both by the membrane alone and when used in combination with autologous bone graft from maxillary tuberosity, found no significant dimensional change between both groups.

As a consequence, **Pinho**[4] summarized that maintaining the space was much more important to the healing than whether bone graft was used or not. In summary, the usage of non-resorbable barrier membrane could reduce the resorption of alveolar ridge after extraction. Nevertheless, the effect disappears if the membrane is exposed.

Lekovic et al[2] studied the use of glycolic and lactide polymer membrane. The results were in agreement with that of **Pinho et al**[4] where the ridge dimensional change in the group with the membrane was smaller than in the control group both vertically (0.38 mm and 1.50 mm) and horizontally (1.32 mm and 4.56 mm) Additionally, the group with the membrane was found to have more bone formation.

There are also numerous studies on the resorbable membrane. A study on collagen resorbable membrane resulted in very small resorption and the new bone was formed enough for implant placement within 3 months after tooth extraction[37].

Luczyszyn et al[31] reported on the use of an acellular dermal matrix membrane in combination with resorbable hydroxyapatite graft. They found that both groups that use only the membrane and the group that uses both membrane and bone graft substitutes could preserve alveolar ridge dimension. But the result of the second group was significantly better. So, it could be concluded that the use of bone graft substitution in combination with a resorbable membrane can yield a better result in preserving alveolar ridge.

Although the membrane can be beneficial,there are two main drawbacks. First, using the membrane may requires at least five to six months of healing period before implant process can be performed.Second,the preparation of the soft tissue for covering the membrane requires the dentist's expertise or else may lead to aesthetics problems.

Lanndberg and Bichacho[32] demonstrated the socket seal surgery technique for ridge preservation. The extraction socket was filled with bone graft substitution materials and the soft tissue graft was placed on the bone graft. The soft tissue graft allowed primary wound closure over the socket orifice which protected bone graft from contamination of bacterial in oral cavity[33, 34], and limited soft tissue shrinkage which leads to a better esthetis of the surgical site.

The survival of free gingival graft placed on the top of a graft-filled socket does not depend only on the characteristics of the graft or the graft harvesting technique, but also depend on the blood vessels that support the free gingival graft.

The vascular supply the soft tissue graft develop from the surrounding gingiva and the plasma part of blood clot in the socket. The presence of the bone graft materials in the socket may interfere the revascularization of the free gingival graft[35] that might hinder the free gingival graft healing.

Preservation of alveolar ridges using bone or bone substitute grafts with/without membrane

Bone grafting is a procedure involving the placement of whole bone or bone substitute material within the bone defect to stimulate incorporation of the graft or the generation of bone tissue. The bone graft materials can be classified by their original source as follows:

- Autograft
- Allograft
- Xenograft,
- Alloplast or synthetic materials.

Materials	**Sources**
Autogenous graft	Bone graft prepared from the patient, which may come from intraoral or extraoral site
Allogeneic graft	Bone graft prepared from others (same species), usually from donors. The bone graft will be prepared through various methods to reduce immune system response. The material will also be sterilized. The allogeneic graft can, either be in mineralized or demineralised form.
Xenograft	Bone graft prepared from difference species. Xenograft is morphologically and structurally similar to human bone. Various thermal and chemical treatment have been used to remove antigenic protein and cellular elements of xenogeneic bone. The materials are usually bovine bone, horse bone, coral, etc.
Alloplast	Synthetic material that usually do not trigger negative immunity or tissue reaction such as group of calcium phosphate transplant materials (Hydroxyapatite, Tricalcium Phosphate), polymer group transplant materials (Chitosan, Collagen, Polycaprolactone)

Table 1: Types and sources of bone grafts

Autogenous bone grafts can be gathered from several intraoral sites, for example, the maxillary tuberosity, edentulous ridges, post-extraction healing sites, and tori or exostoses. The origin of intraoral bone also plays a crucial role. Bone harvested from the area with predominantly cortex bone usually has little osteogenic potential. On the other hand, bone harvested from the area with predominantly cancellous bone has better osteogenic potential.

Becker et al 1994[36] compared demineralized freeze-dried bone allograft against autogenous bone graft in seven paried sites and found that after three months new bone was found at all sites where autogenous bone was placed,where as new bone was found in only one of the seven sites where demineralized freeze-dried bone allograft was placed.

Clementini et al 2011[37] found out a success rate of 72-97% in implants placed in onlay graft regenerated ridges in a 6months to 10 years period.

Araujo et al (2011)[38] conducted a study that used autologous bone chips as graft materials and found that it had little effect on bone formation and in promoting alveolar ridge preservation.

Although autogenous bone is the best candidate for repairing osseous defect, its limited volume and requisition of additional surgery indicate a need for an alternative. Allografts, xenografts, and alloplasts, either in a block or particulate form, can also be used as an alternative bone graft material.

Allografts consist of tissue transferred from one individual to another within the same species. Allografts are widely used because the materials do not require a secondary surgical site and so host morbidity is decreased. The graft materials can be classified as demineralized freeze-dried bone allograft (DFDBA) or freeze-dried bone allograft (FDBA).

Buck be et al 1990[39] It is possible to add an osteoinductive property to the already osteoconductive bone by demineralizing the material causing the releasing of bone morphogenic proteins (BMPs). One disadvantage of using allograft is its risk of transmitting disease, however, there have been no report of viral contamination or

acquired pathology from the use of DFDBA or FDBA[40,41]. Freezing the bone allograft can further reduce the risk of contamination to one in eight million.

Delloye et al, 2007[42] stated Transmission of hepatitis C and human immunodeficiency virus (HIV) have been well documented in allograft transplants. As a result of the risks associated with disease transmission, allografts are required to undergo extensive sterilisation, typically by irradiation. However, these procedures are reported to diminish the mechanical integrity (**Cornu et al, 2000**)[43] and osteoinductive properties (**Han et al, 2008**)[44].

Shigeyama et al, 1995[45] found out Commercially prepared allografts are reported to contain BMP-2, BMP-4 and BMP-7, at lower concentrations than from fresh bone preparations. Allograft quality is also donor-dependent and variations in clinical outcome also depend upon the processing and handling methods of the allograft (**Calori et al, 2011**)[46].

Studies conducted by **Aspenberg (1988)**[47]**, Becker (1994)**[36] **and Froum (2011)**[48] using DFDBA showed that DFDBA could not speed up bone formation and showed little new bone formed around DFDBA.

Xenografts are tissue grafts transferred between different species. Several short-term studies indicated that the placement of xenografts in alveolar sockets could advocate bone formation and ridge preservation, but may also delay healing.

Araujo (2009)[49] conducted a study to evaluate long-term effects on bone formation and the ridge augmentation from the usage of Bio-Oss collagen® (Geistlich Pharma North America, Inc.), a xenogeneic graft, in extraction sockets in five beagle dogs. The use of Bio-Oss collagen® showed improved preservation of the alveolar process and ridge profile when compared to the non-grafted sites.

Another study by **Eskow (2014)**[50] on human subjects comparing the use of Bio-Oss collagen® versus clot only (control group) showed that new bone formation in augmented sites (test) was merely **25%** compared to **44%** in the non-augmented sites (control). This result confirmed a delay in bone formation in grafted sites as mentioned in various studies.

One of the most commonly used xenografts is deproteinized bovine bone mineral (DBBM). The material was able to stay inside the extraction socket for an extended period of time.

Artzi 2000[23] conducted a 9 month study in which, the DBBM graft material prevail evenly throughout the extraction socket and averaged an overall **30%** residual graft at the end of the study period.

Lee (2009)[51] in another study comparing dbbm with irradiated cancellous allograft, and dbbm with solvent dehydrated allograft in preservation of socket concluded that dbbm was a favorable graft for the ridge preservation. The authors also noted that DBBM grafts may be useful where new bone was desired, and a slower resorption rate of the graft was preferred. These studies were only a few examples that prove xenografts as viable materials for ridge preservation.

Alloplasts are synthetic inert materials implanted into tissue. Common examples are hydroxyapatite, tricalcium phosphate, calcium sulfate and bioactive glass. These graft materials are osteoconductive, which help serve as a scaffold for new bone formation.

Hydroxyapatite is one of the synthetic graft materials. In a study on five beagle dogs by **Lindhe J et al 2013**[52], an alloplastic graft (biphasic alloplastic graft (BPCAP); α-TCP(tri calcium phosphate) core coated with nanocrystalline biomimetic

hydroxyapatite embedded in porcine collagen was used as graft materials for the extraction socket of the premolar sites. The clinicians documented that the biphasic alloplastic graft did not undergo marked resorption, but allowed new bone formation within the post-extraction site.

In another study, **Shakibaie 2013**[53] compared the effectiveness of a synthetic material consisting of hydroxyapatite and silicon dioxide (NanoBone) and the Bio-Oss® (Geistlich Pharma). The result showed that the alveolar ridge was better preserved with Bio-Oss than with NanoBone or without treatment.

Nemcovsky and Serfaty et al 1996[54] studied the use of hydroxyapatite in fresh extraction sockets in a series of 23 cases and reported to have achieved primary closure by rotating split thickness flaps for a period of 24 months follow up. They showed that there was predictable ridge preservation with minimal postoperative ridge deformation (1.4 mm vertically and 0.6 mm horizontally). they claimed that this would retain sufficient bone volume to allow implants to be inserted. However, over half the patients experienced some exfoliation of hydroxyapatite suggesting that the flap design was not predictable in maintaining soft tissue closure.

Forum et al[48] did a comparative study between DFDBA , control socket and bio active glass (bio gran) in fresh extracted socket. All sites were covered by flap advancement and re-entered six to eight months later. The placement of **Biogran** resulted in **60 per cent** bone vitality, a measure of new bone formation, with the control and **DFDBA** sites showing approximately **33 per cent.** However, it should be noted that all sites were to receive implants, which suggests that there may be little benefit of using a graft material.

The placement of calcium sulphate has been studied in a recent paper. **Guarnieri et al**.[55] placed calcium sulphate in 10 extraction sockets without a barrier membrane and re-entered the sites at three months. The graft material had readily resorbed with 100 per cent bone infill and implants were able to be placed at all sites. It should be noted that there is again a general lack of studies reporting on the use of calcium sulphate, with which the authors of the above paper concur.

One study has looked at the use of bioactive glass and calcium sulphate together[56.] No statistical difference was found between experimental and control groups, casting doubt on the use of these materials in combination.

Another product that was used to graft extraction sockets is BioPlant HTR™. It is a biocompatible microporous composite of methacrylate and calcium hydroxide. **Haris et al 1998**[57] reported that after a period of 8 to 12 months there was sufficient hard tissue to place implants.

Except for the study by **Guarnieri et al.**[55] in each of the above papers residual particles of the graft were found at time of re-entry and raises the question of what effect this may have on implant placement. If most bone infill is along the socket walls and base, then any remaining particles may be removed during the osteotomy.

Selection of graft materials for socket preservation

Grafting materials for socket preservation can be classified as

1) long-term,

2) transitional,and

3) short-term.

Non-resorbable materials are usually discussed in the long-term preservation context because of their nonresorbable character, but in fact, even the nonresorbable materials undergo some physiochemical dissolution. The nonresorable materials do not fully resorb and get replaced by a natural bone. Therefore, the nonresorbable materials are not advisable to be placed into sites with the possibility of later dental implant placement because the residual graft materials will prevent the integration of implant fixture to natural bone. Nevertheless, the nonresorbable characteristic nature makes them suitable for long-term ridge maintenance. Common materials for the purpose includes porous coralline HA, bioactive glass, porous polymethyl methacrylate, synthetic HA.

Grafting material for transitional ridge preservation is usually marketed as being resorbable, but with a time duration of 4-12 months period for new bone formation. These grafting materials are useful for developing bone density and are used in medium-term ridge preservation. Frequently, patients may not immediately decide to undergo implant therapy immediately after they lose their tooth, but eventually desire to undergo the therapy at a later date. Grafting material for transitional ridge preservation allows patients to take some decision period before the implant. Materials in this category include anorganic bovine bone matrix (ABM), resorbable calcium phosphate ceramics, and macroporous bioactive glass, and deproteinized bovine bone with collagen.

Short-term resorbable materials are those that can readily be resorbed and replaced by host tissue over the typical healing period. The objective of using short-term ridge preservation is to maintain bone mass during the initial healing stage with the expectation to start implant process within 3 to 6 months.

Similar to the materials for transitional ridge preservation, they increase bone density, prevent early ridge resorption, and facilitate the placement of dental implants. The material in this category includes Freeze-dried bone allograft (FDBA), Demineralized freeze-dried bone allograft(DFDBA), and autogenous bone.

Tooth as bone graft material

The tooth has been the area of interest as a bone substitute because of its similar morphology and microstructure to bone. Tooth components have biocompatibility property and also has growth factors that encourage osteoinduction. However, a proper preparation process is required in order to preserve osteoinduction property in graft materials. Because of its many beneficial characteristics, the usage of the tooth as bone substitution has been studied in a myriad of in Vitro study, in Vivo study, and clinical applications.

Similarity between tooth and bone

Tooth, cartilages, nerves, and maxillofacial bones are all embryologically derived from the neural crest1-4. The compositions of these parts of the body, especially tooth (dentin) and bones, are very similar. Dentin is composed of **65%** inorganic substances, **35%** organic substances, and water. Cementum is also made up in a very similar ratio of **45-50%** inorganic substances, **50-55%** organic substances, and water. Alveolar bone is made up of an even more similar ratio of **65%** inorganic and **35%** organic substances.

Both bone and tooth are hard tissue with similar morphology and microstructure which can be seen in Figure 1 despite differences during the developmental period. Alveolar bone, as well as dental tissues such as enamel, dentin, cementum, pulp, and periodontal ligament, are developed from the neural crest cells. While bone is built from multiple Harversian's systems, dentin built up as a complex hydrated composite of 4 components: 1) oriented tubular 2) a high mineralized peritubular zone embedded in an intertubular matrix 3) type I collagen with embedded apatite crystals and 4) dentinal fluid.

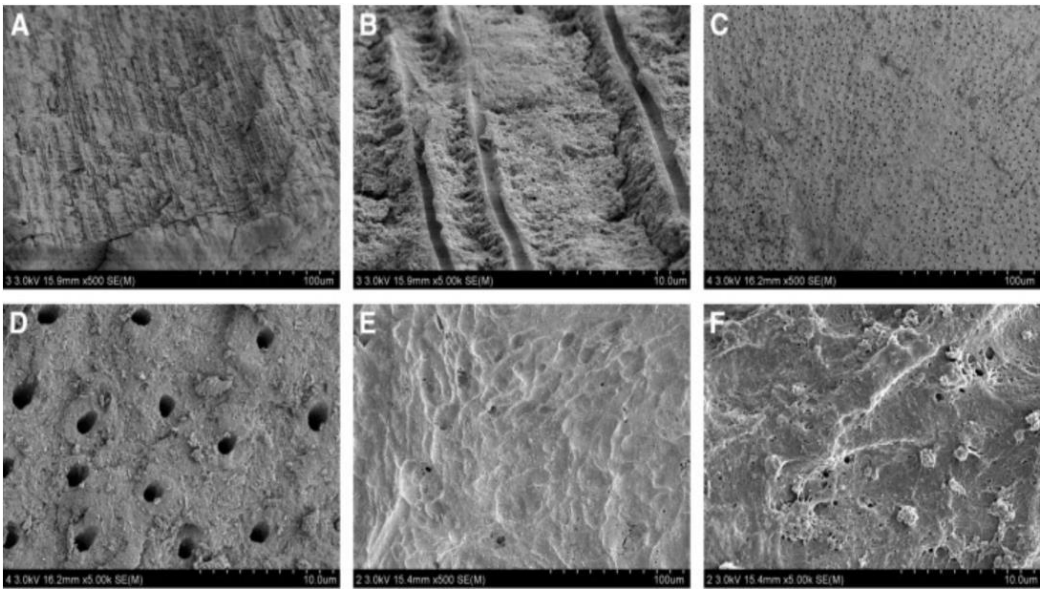


Figure 1: SEM views of the different types of graft materials. A, tooth crown (×500); B, tooth crown (×5000); C, tooth root (×500); D, tooth root (×5000); E, autogenous cortical bone (×500); F, autogenous cortical bone (×5000);

Dentin structure and constituents

Dentine is a mineralised tissue present within mammalian teeth that resides between the outer layer of enamel and pulp chamber, with the main function of protecting the dental pulp. Dentine is secreted and maintained by odontoblasts, which

reside on the boundary of the dentine and pulp, and project cell processes into tubules present within dentine **Arana-Chavez and Massa, 2004**[58]. These tubules are typically around 2-4μm in diameter and are present at an abundance of around 20,000/mm^2 **Schilke et al, 2000**[59]**.**

By weight, dentine is composed of **70%** mineral, **20%** organic protein and 10% water **Goldberg et al, 2012**[60], similar to bone, which contains **60%** mineral, **25%** organic matrix and **15%** water. Around **90%** of the organic matrix of dentine and bone consists of type I collagen (**Berkovitz et al, 2011**[61]), with the remaining **10%** consisting of NCPs(non collagenous protein) (**Butler and Ritchie, 1995**[62]). These include BSP(bone sialoprotein), dentine matrix protein 1 (DMP-1), dentine sialoprotein (DSP) and dentine phosphoprotein (DPP), with the latter two being characteristically found in dentine. These NCPs belong to a family of molecules called the small integrin-binding ligand N-linked glycoproteins (siblings), which contain RGD(arginine,glycine and aspartate) domains for which function as nucleating factors for the process of mineralization **Smith et al, 2012**. [63]

While presence of these ECM proteins has been long established, the vast proteome of dentine has only recently been extensively studied. The first comprehensive proteomic analysis of human dentine revealed 233 total proteins [29] from three different patients, with sixty-eight of these proteins common between donors. **Park et al, 2010**.[64]

Chun et al, 2011[65]revealed 147 ethylenediamine tetra-acetic acid (EDTA) soluble tooth proteins, which were confirmed by sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) and liquid chromatography/mass spectroscopy (LC/MS). The extracted proteins when co-cultured in osteogenic

differentiation medium exhibited differentiation enhancement of dental pulp-derived, stem cells (DPSCs), to produce mineral deposits.

In addition to a range of matrix proteins, dentine also serves as a reservoir for a number of bioactive growth factors. TGF-β1(transforming growth factor) has been identified as a pertinent growth factor in dentine with roles acknowledged for migration and proliferation of dental pulp-derived cells (**Nie et al, 2006**[66]**; Howard et al, 2010**[67]). Crucially, TGF-β1 is implicated in odontoblast differentiation and subsequent matrix production in dentinogenesis (**Smith et al, 1995**[68]**; Tziafas 2000**[69]).

FGF-2(fibroblast growth factor) induces migration (**Suzuki et al, 2011**[70]) and proliferation of dental pulp cells (**He et al, 2008**[71]). PDGF(platelet derived growth factor) enhances proliferation of fibroblasts in human dental pulp (**Rutherford et al, 1992**[72]), in addition to stimulating expression of DSP in rat dental pulp cells (**Yokose et al, 2004**[73]).

VEGF(vascular endothelial growthfactor) serves to induce endothelial differentiation of human dental pulp cells (**Marchionni et al, 2009**[74]) and has been shown to increase micro-vessel density in human severed dental pulps (**Mullane et al, 2008**[75]).

IGF-1(insulin like growth factor) is proposed to drive differentiation of dental pulp cells (**Joseph et al, 1993**[76]**; Caviedes-Bucheli et al, 2007**[77]). BMPs possess potent effects on differentiation of dental pulp cells, notably BMP-2, BMP-4 and BMP-7 (**Nakashima et al, 1994**[78]**; Saito et al, 2004**[79]).

Biocompatibility and Osteoinduction property of dentin

Dentin has been proposed as bioinert bone substitutes providing osteoconductive scaffolding similar to those of autogenous bone. Another advantage of dentin over hydroxyapatite is that it contains organic matrix which induce bone formation.

Moharamzadeh et al.[80] revealed that in vivo implantation of prepared dentin into rat femurs exhibited biocompatibility without fibrous connective tissue layer and inflammatory reaction. New bone was formed between the implant and surrounding bone.

Both homogenous demineralized dentin matrix (HDDM) and autogenous demineralized dentin matrix (ADDM) are biocompatible and are able to promote osteoinduction since both materials can induce ectopic bone formation without fibrous encapsulation and host immune rejection[81]. During the preparation of HDDM, the demineralization process does not denature its osteopromotive ability. So, HDDM stays as a reservoir of biochemical factors that induce cell differentiation, cellular proliferation, and chemotaxis[82].

Gomes et al.[83] studied the bone reconstruction process after the implantation of HDDM slices in surgical defects in rabbit parietal bones. The author reported that HDDM was biocompatible and can stimulate bone tissue formation. The result showed that HDDM was well accepted by the rabbits and is completely fused into the newly formed bone tissue.

Osteoinductive cannot be exerted only by BMPs alone without carriers. So the scaffolds, which functions as a carrier, are used to contain BMPs at the graft sites[84]. An optimal carrier should be able to control release growth factors as well as prevent

degradation and inactivation[85]. Clinicians use different carrier materials for different purposes. The most widely used materials are Collagen and TCP. For the specific purpose of delivering BMPs and growth factors, collagen, calcium phosphates, and polyesters such as polycaprolactone have been used[86, 87].

DDM is another scaffold material for the releasing of BMPs62-64. **Ike and Urist**[88] recycled extracted teeth by using root portion of the tooth as a carrier for recombinant bone morphogenetic protein-2 (rhBMP-2). New bone formation was observed when DDM was used as carrier although the quantity of BMP in teeth is very limited[89]. Through many studies on the biochemical and histomorphometric properties of bone and cartilage induced by human DDM and BMP-2, researchers found that human DDM could induce bone formation, and BMP-2 can significantly accelerate bone formation in the DDM carrier system[90].

In Vitro and in Vivo studies

Several studies demonstrated the potential of autogenous dentin graft in different preparation forms as bone grafts substitutes. The results were consistent in yielding or promoting new bone formation. Several clinical studies indicate that dentin has the potential to be used as a bone substitute in bone regeneration regardless of the differences in preparation form or processes.

Lee et al (2011)[91]concluded after comparing the efficiency of autogenous DDM and other bone graft materials used in sinus bone graft surgeries; after four 4 months of healing, there was favorable bone formation, but autogenous DDM revealed faster rate and superior quality of bone formation. Similar results were obtained by **Jeong et al in 2011**[92]while carrying out maxillary sinus augmentation using auto- tooth bone graft material.

Park et al (2012)[93]demonstrated that auto-tooth bone graft material is a good bone graft material with osteoconduction and osteoinduction capacities to replace autogenous bone.

Murata et al (2012)[94] demonstrated that appropriate carrier is needed for the BMPs and growth factors to be incorporated as bone grafts and concluded that DDM by itself can play the role of a carrier of exogenous BMP and growth factors as well as have osteoinductive effect.

Kim et al (2013) [95] showed that ADDM, with absence of antigenicity, enhances bone-remodelling capabilities the tooth-derived bone graft may be considered as an option for its autogenous origin and favourable clinical and histological outcomes when teeth extraction is necessary.

Chang et al in 2014[96] performed a guided bone regeneration (GBR) followed by implant placement and prosthetic restoration and results showed that no significant marginal bone loss difference radiographically immediately after GBR, implant placement, and prosthesis delivery.

Kim et al (2014)[97]evaluated the clinical efficacy of autogenous tooth bone graft material (AutoBT) in alveolar ridge preservation of an extraction socket on thirteen patients who received extraction socket graft using AutoBT followed by delayed implant placement and concluded that autogenous tooth bone graft material can be considered as a favorable bone substitute for extraction socket graft due to its good bone remodeling and osteoconductivity.

Binderman et al (2014)[98]demonstrated that autogenous mineralized dentin particles can be employed as bone grafts for socket preservation, bone augmentation in sinus and bone defects by preparing freshly extracted teeth into a bacteria free

dentin graft and grafting them immediately into extraction sites and bone deficiencies followed by successful placement of implants.

Joshi et al (2016) [99] suggested that postextraction, ridge preservation leads to more predictable maintenance of alveolar ridge height and width, and ATG as compared to β- TCP provided superior results. **Valdec et al (2017)** [100] showed that particulated dentin autologous teeth may serve as an alternative to autologous bone for alveolar ridge preservation prior to implant therapy.

Guiradoa et al (2018)[101] based on experimental studies concluded that autogenous dentin particulate grafted immediately after extractions may be considered as a useful biomaterial for socket preservation , protecting both buccal and lingual plates, generating large amounts of new woven bone formation after 60days, and small amounts of lamellar bone after 90days healing.

Despite the preliminarily promising results of AutoBT as a bone graft substitute, there are certain disadvantages. There is a limited productivity for commercialisation due to required dehydration, which decreases shelf-life (**Kim, 2014**)[97]. Furthermore, whilst harvesting dentin from a single tooth provides insufficient volume of particulate to fill extraction sockets (**Binderman et al, 2014**[98]).

The advantages of autologous dentin graft over xenogeneic or alloplastic bone graft substitution are

1) the tooth matrix is autologous; thus, the possibility of graft rejection is low,

2) the graft is osteoinductive since it contains various growth factors including

a)Bone morphogenetic proteins (BMPs),

b)Transforming growth factor-beta (TGF-β),

c) Insulin-like growth factor -1 and -2 (IGF-1 and-2) and

3) the cost of graft is cheaper than commercially available xenograft or alloplastic bone graft substitutes..

As discussed above there are various materials available for socket preservation. This present study investigated the use of autologous dentin graft in freshly extracted sockets for the purpose of socket preservation and has proven to provide promising results for the use of the same in future for regenerative surgical procedures as a alternative to the commercial available bone graft substitutes..

MATERIALS & METHODS

SOURCE OF DATA:

A study population of 10 subjects were selected from the outpatient section of Department of Periodontology, Tamil Nadu Government Dental College & Hospital, Chennai, Tamil Nadu, India.

INCLUSION CRITERIA:

1. Age between 20 and 50 years
2. Systemically healthy patients.
3. Patients who have not undergone any type of regenerative periodontal therapy over a period of 1 year prior to the initial examination.
4. Patients without any antibiotic treatment in last six months.
5. Patients with ability to perform adequate oral hygiene.
6. Patient having a vital tooth indicated for extraction which could be used for autograft.
7. Patient who received instruction on the purpose of the clinical study and gave his /her consent.
8. Patients in treatment for anemia

EXCLUSION CRITERIA:

1. Subjects who have received periodontal flap / regenerative therapy within the past 1 year
2. Pregnant and lactating patients
3. Alcoholics and Smokers
4. Patients who demonstrate poor oral hygiene maintenance.

5. Patient who has received radiation therapy.
6. Systemic illness known to affect the outcomes of periodontal therapy; such as diabetes mellitus, cardiac diseases, immune-compromised (e.g. HIV individuals, under radiotherapy) , patients taking medications such as corticosteroids, calcium channel blocker or bisphosphonates which are known to interfere with the outcome.
7. Patients with any known allergy to drugs
8. Patient who has acute infections.

STUDY DESIGN

Ethical clearances were obtained from the Institution Ethical Committee and the ethical principles were meticulously followed throughout the study. Subjects for the study were selected randomly if they are fulfilling inclusion criteria, with no discrimination on the basis of sex, caste, religion or socioeconomic status as long as they are ready to follow oral hygiene instruction and other pre-operative and post operative instructions. After detailed explanation of the surgical procedure its risk and advantage, written informed consent was obtained from all the subjects selected for the study. Clinical examination was proceeded by complete dental and medical history. A total of 10 patients were selected for the study.

STUDY PROTOCOL

1. Institutional ethical committee approval
2. Obtaining medical history and informed consent.
3. Intra oral evaluation and periodontal evaluation

4. Radiographic evaluation (IOPA) of selected edentulous region.

5. cone beam computed tomography (CBCT) evaluation of the selected edentulous region to determine,

a) Mesio-Distal width of edentulous area.

b)Labio-palatal width of the edentulous area.

c)Height of edentulous area.

d) Presence of any pathology

6. Clinical photographs & study models.

7. Phase 1 therapy.

8. Pre surgical preparation such as stent preparation.

9. Surgical procedure (atraumatic extraction,.autogenous dentine graft preparation, and placement in the socket.).

10. Post operative care.

11. Clinical re-evaluation at the end of 1 week and & 6 months.

12. CBCT re-evaluation at the end of 6 months.

PARAMETERS

CLINICAL PARAMETERS:

CLINICAL EVALUATION BY BOLEY'S GAUGE WITH STENT:

Boley gauge is a device used for perfectly measuring length, width, and thickness of tooth in millimetre increments. The metric scale on the gauge can be used for determining exact dimensions of tooth and edentulous space.

RADIOGRAPHIC PARAMETERS:

CBCT evaluation of socket width.

CBCT evaluation of socket height

Clinical evaluation socket width

Clinical evaluation of socket width was recorded, immediately after extraction (Day 0) and at the end of 6months, by using Boley's gauge and prefabricated custom made acrylic stent (*Photograph* 4).

Stent Preparation

Self cured clear acrylic stents were custom fabricated over the study models**.** The reference vertical stop was created by extending the stent over the occlusal and coronal 1/3 rd of the labial and palatal surfaces of at least one tooth on either side adjacent to the edentulous spaces with their flanges extending cervically over the edentulous region. Presence of wax spacer, relief over the occlusal surface of edentulous region and vertical stop allowed the use of same stent for that particular patient pre operatively and post operatively. Reference holes were made on both labial &palatal side of flange, to guide the placement of the Boley's gauge in the same plane and direction during measurements, to avoid any variation. The measurements of ridge width were made using a Boley's gauge. *(Photograph 7)*

CBCT evaluation of labio palatal ridge width :

Care stream 9300 CBCT System was set at 120 kV, 70 mA with tube focal spot of 0.7 mm and the CBCT scan was done with the patient in erect position and the sectioning of the region of interest was done using **CS 3D Imaging Software 3.3.9.0**

A reference point was marked by the following criteria:

In sagittal section,

POINT A -most cervical point of cemento enamel junction (CEJ) on surface adjacent to edentulous region on the mesial tooth was marked (eg.pt A).

PONT B - most cervical point of cemento enamel junction (CEJ) on

surface adjacent to edentulous region on the distal tooth (eg.pt B).

In axial view, a reference

POINT C - line was drawn by joining pt A & pt B. Exactly the midpoint was marked on the reference line (eg. pt C) and used as reference point (*Photograph* 36 & 37).

POINT D – tangential line drawn from point c to the height of the socket

POINT E - Points pt E marked 5 mm from the pt C on the tangential line .

POINT F - Points pt F marked 10 mm from the pt C on the tangential line.

Measuring pre-operative values:

A sagittal section of the edentulous region was obtained from the CBCT. The sagittal slice/plane was positioned and selected in such a way that it coincides with the reference point, which marked the axial view. A tangential line was drawn to the ridge from the reference point. On the tangential line certain points were marked (eg. pt D, pt E & pt F) at a particular distance from the reference point- pt C. Distance between points (pt C & D) might vary from patient to patient but constant for pre operative & post operative evaluation of the same patient. Points pt E & pt F were marked 5 mm and 10 mm from the pt C. Labio palatal width of the alveolar ridge were measured horizontally in relation to the pt C, pt E & pt F and considered as crest level, 5 mm from crest level and 10 mm from crest level values respectively

Measuring post operative values:

The post operative values are calculated after a period of 6 months, The post operative labio palatal width of the selected region was measured.

Difference in labio palatal width of ridge was calculated by subtracting the pre operative values from the 6 month post operative values.

Armamentarium:

For Clinical Examination:

- Mouth mirror
- Williams Periodontal probe
- Kidney tray
- Cotton roll
- Sterilized disposable gloves, head cap, facemask
- IOPA film with radiographic grid

For Phase I therapy:

- Mouth mirror
- Williams Periodontal probe
- Kidney tray
- Ultrasonic scaler(Guilin Woodpecker,UDS-J ultrasonic scaler)
- Cotton rolls
- Sterilized disposable gloves, head cap, face-mask
- Disposable syringes
- Local anaesthetic solution(2% lignocaine hydrochloride with adrenaline 1:80000)

For Phase II Therapy

- Mouth mirror
- Williams Periodontal probe
- Disposable syringes
- Local anaesthetic solution(2% lignocaine hydrochloride with adrenaline 1:80000)

- Surgical blades
- Curettes and scalers
- Periosteal elevators
- Hu-friedy periotome
- Extraction forceps
- Scissors
- Needle holders
- Suture material 3-0 black silk braided
- Normal saline
- gauze
- Sterile dentin grinder, conventional domestic grinder
- seive
- Cement spatula and Glass slab
- Non eugenol periodontal dressing(Coe pacTM)

SURGICAL PROCEDURE

Following screening, all patients were consented to the planned treatment strategy. The patient was advised to start pre operative antibiotics (Cap.Amoxycillin 500 mg three times a day, 1 day before surgery) and Tab.Ibuprufen 400mg 1 hour before surgery.

- All patients were instructed to use 2% Chlorhexidine mouth rinse immediately before surgery. After adequate local anesthesia (2% lignocaine with epinephrine, 1:200,000), an intrasulcular incision made around the involved tooth. Atraumatic extraction of the compromised tooth done carefully to avoid damage to the

surrounding alveolar bone. Periotome is used to release the periodontal ligament. Once the tooth removed , the socket is carefully debrided with curette and irrigated with saline .

PREPARATION OF AUTOGENOUS DENTIN GRAFT:

Enamel in toto, discolored dentin,cementum or remnants of Periodontal ligament (PDL) and calculus if any are reduced by tungsten bur. Clean teeth including crown and root dentin are put into a grinding sterile chamber of a high speed dentin grinder. The 'High speed sterile dentin grinder"conventional domestic mixer grinder with 150W with speed of >700RPM is capable to grind the roots into particles of less than 1200 μm . These particles are separated through a sieve that keeps particles between 500-1200 μm. This fine particulate (less than 300 μm) is considered as a non-efficient particulate size for bone grafting. This grinding and sorting protocol is repeated to grind the remaining teeth particles left in grinding chamber. To achieve graft sterilization, the graft particles were immersed in 1N lactic acid for 15 – 20 min which also partially decalcified them. Later using sterile normal saline, graft particles were thoroughly washed for 60 sec to remove any residual traces of lactic acid.

The material is then placed in the socket and primary wound closure with interrupted, non-absorbable braided black silk 3-0 sutures (Mersilk (Ethicon) – Johnson &Johnson pvt Ltd, India) was done and periodontal dressing placed.

POST-SURGICAL CARE

Post-operative instruction for patient:

1. After finishing the procedure, patients were made to take analgesic medication

within 30 minutes before local anaesthetic effects wear off.

2. Avoid the surgical site while brushing and eating.

3. 0.2% chlorhexidine mouthwash two times a day for 2 weeks,

4. Post-operative antibiotic and analgesics:

Cap : Amoxycillin 500mg thrice a day for 5 days.

Tab : Ibuprofen 400 mg twice a day for 3 days.

Patient allergic to above medication, alternate medications were prescribed.

Tab : Ciprofloxacin 500 mg thrice a day for 5 days.

Periodontal dressings and sutures were removed 7–10 days postoperatively.

PHOTO 1:ARMAMENTARIUM

PHOTO 2 : ARMAMENTARIUM FOR GRAFT PREPARATION

PHOTO 3 : TOOTH GRINDER

PHOTO 4: BOLEY GAUGE

PHOTO 5 : PRE OPERATIVE BUCCAL VIEW

PHOTO 5A:PRE OPERATIVE VIEW

PHOTO 6: EXTRACTED SOCKET

PHOTO 6A:EXTRACTED SOCKET BUCCAL VIEW

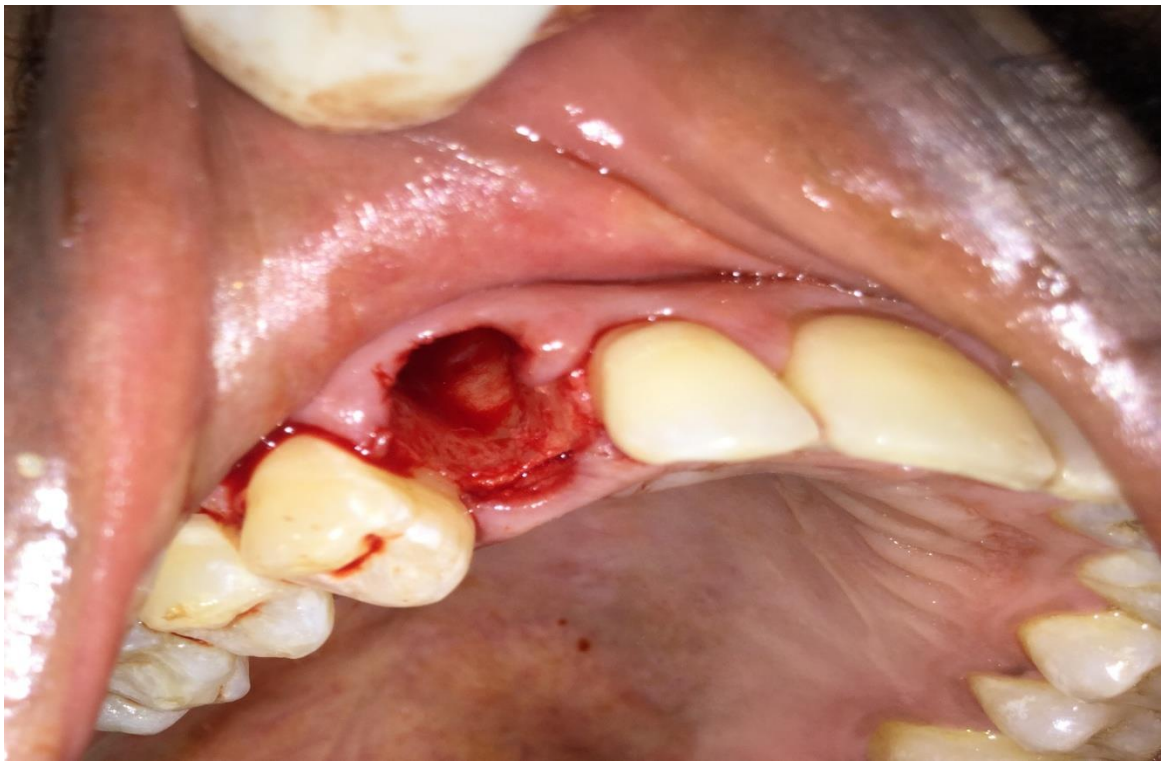


PHOTO 7: PRE OPCLINICAL MEASUREMENT WITH BOLEY GAUGE

PHOTO 8:EXTRACTED TOOTH

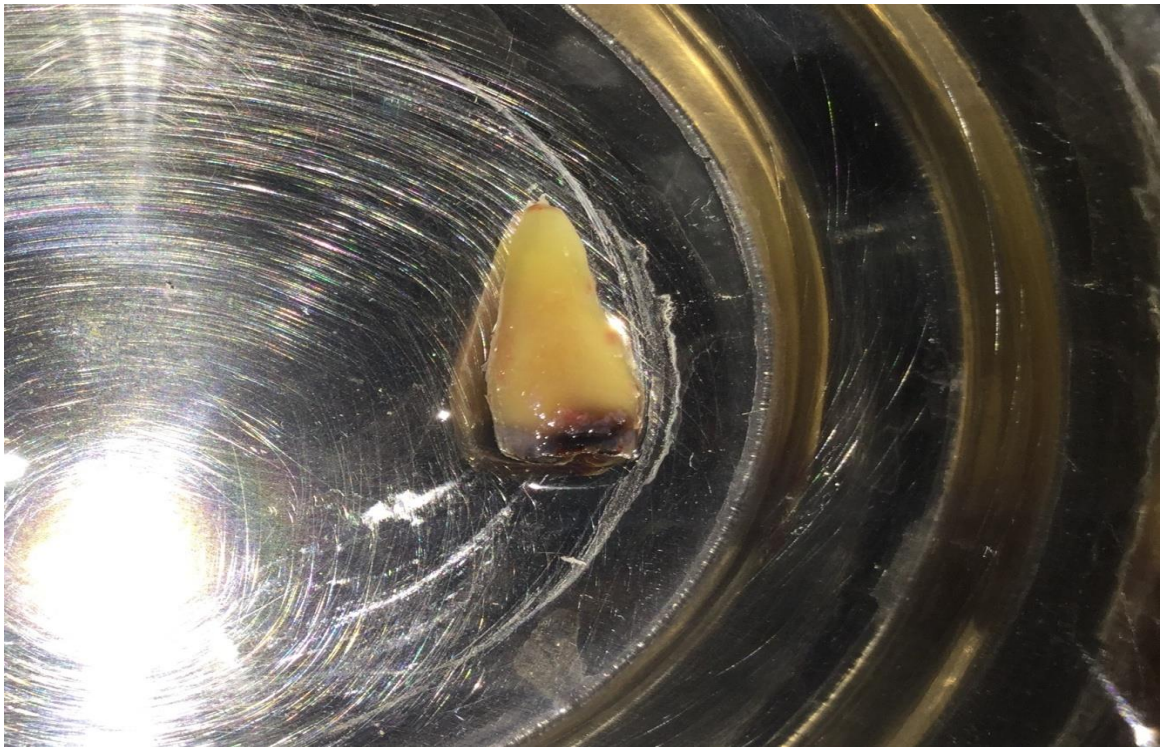


PHOTO 9:CLEANED AND SECTIONED TOOTH

PHOTO 10:SECTIONED TOOTH PLACED IN GRINDER

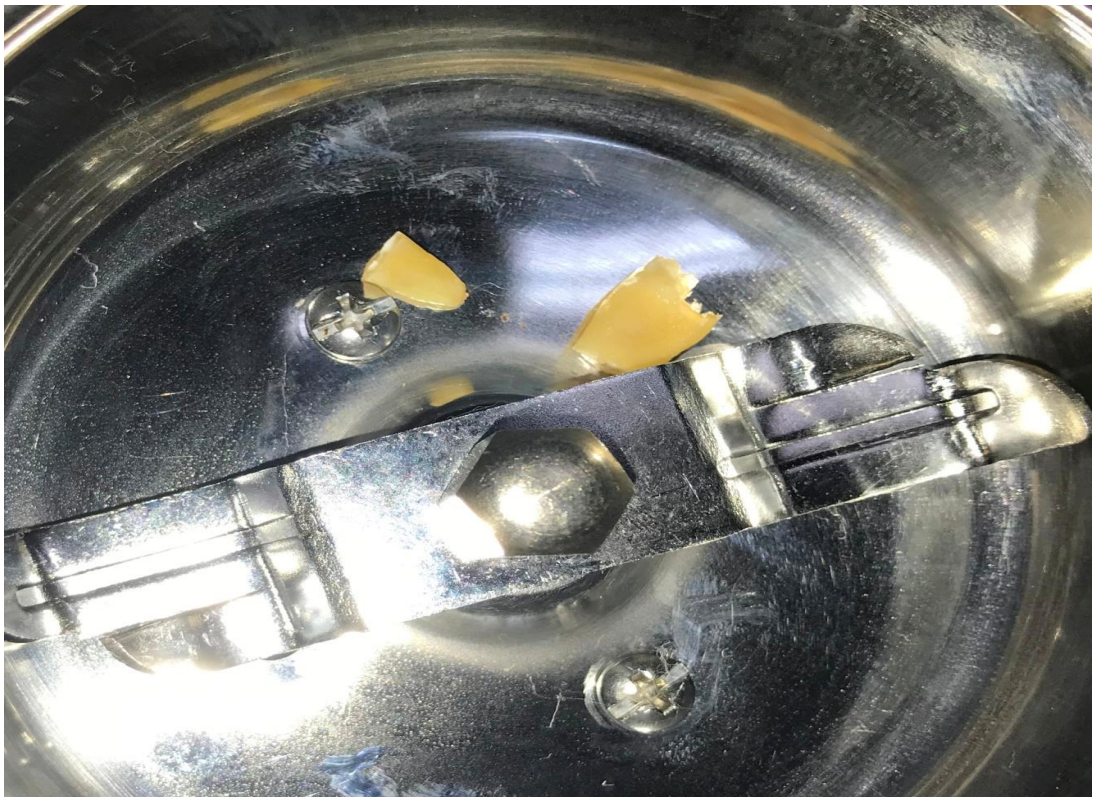


PHOTO 11: AUTOGENOUS DENTINE GRAFT PREPARED

PHOTO 12:GRAFT PARTICLE PASSING THROUGH 1200µm SIEVE

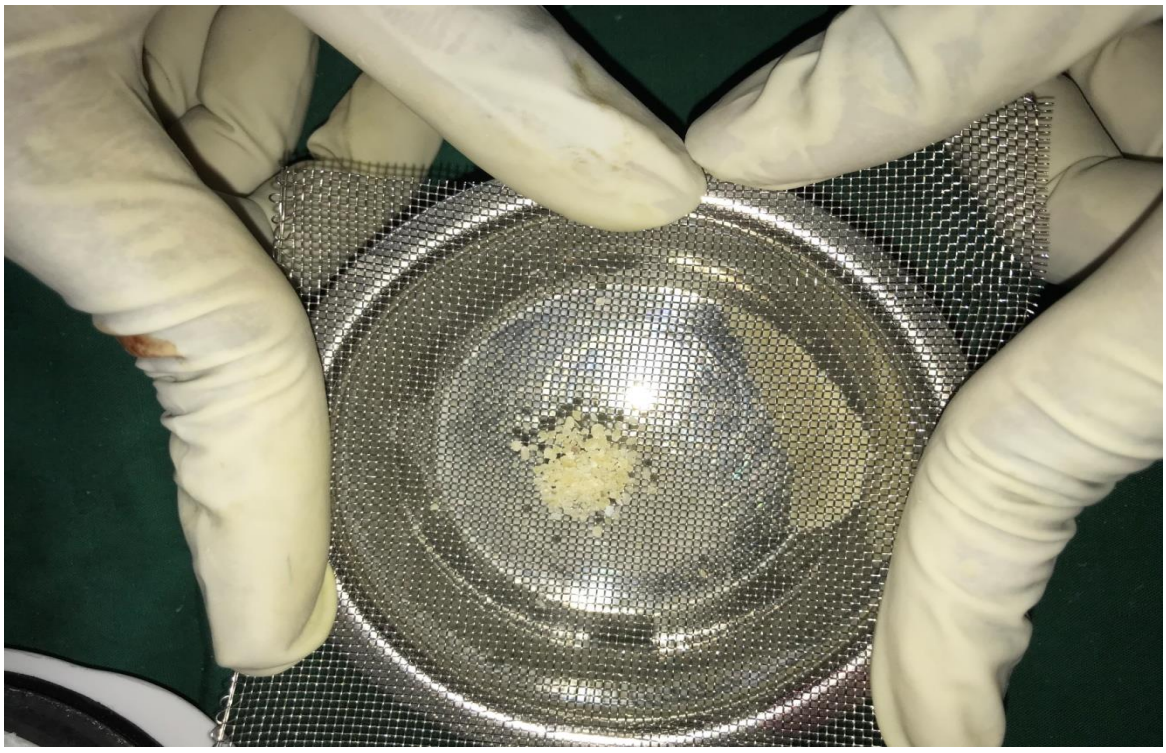


PHOTO 13:GRAFT PARTICLE PASSING THROUGH 300µm SIEVE

PHOTO 14: GRAFT PARTICLE PLACED IN LACTIC ACID

PHOTO15: GRAFT PARTICLE PLACED IN SALINE

PHOTO 16: FINAL AUTOGENOUS GRAFT OBTAINED

PHOTO 17: GRAFT PLACED

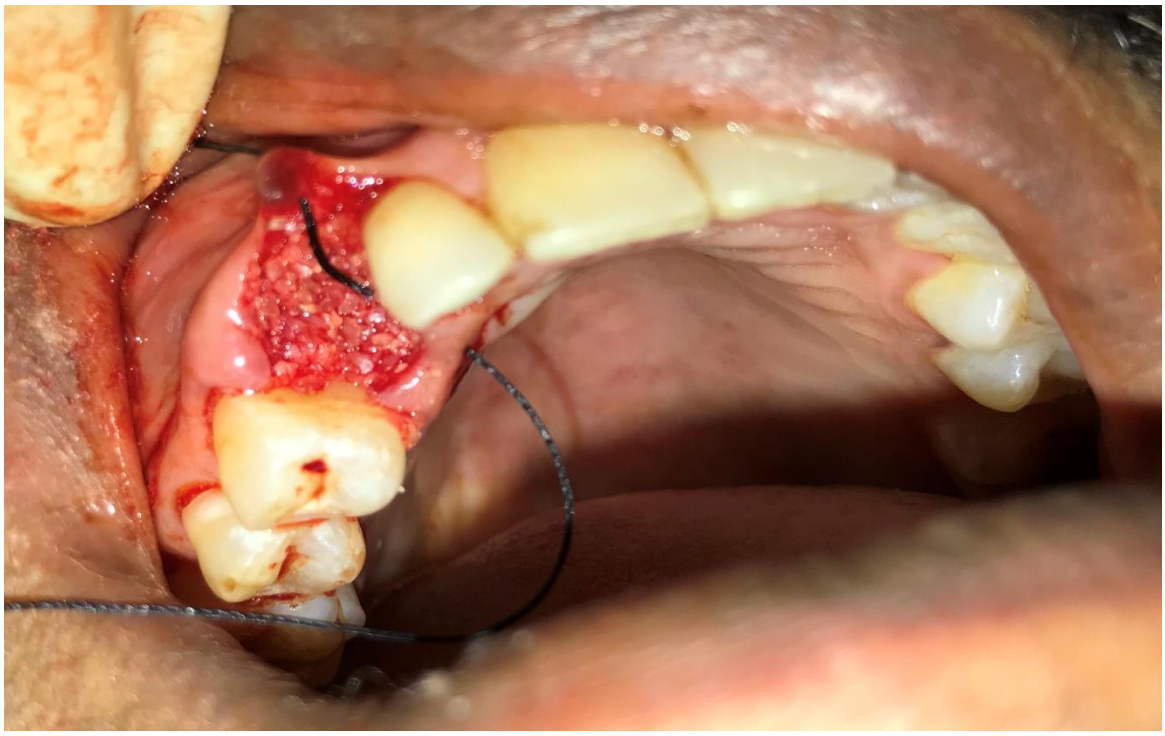


PHOTO 18: SUTURED

PHOTO19: POST OP 6 MONTHS

PHOTO 20: POST OP CLINNICAL MEASUREMENT USING BOLEY GAUGE

PHOTO 21: PRE OP CBCT

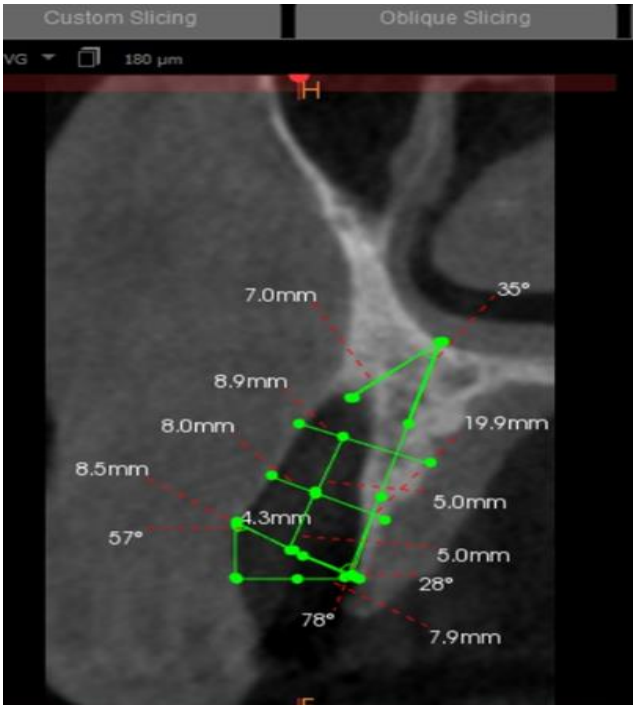


PHOTO 22: POST OP CBCT

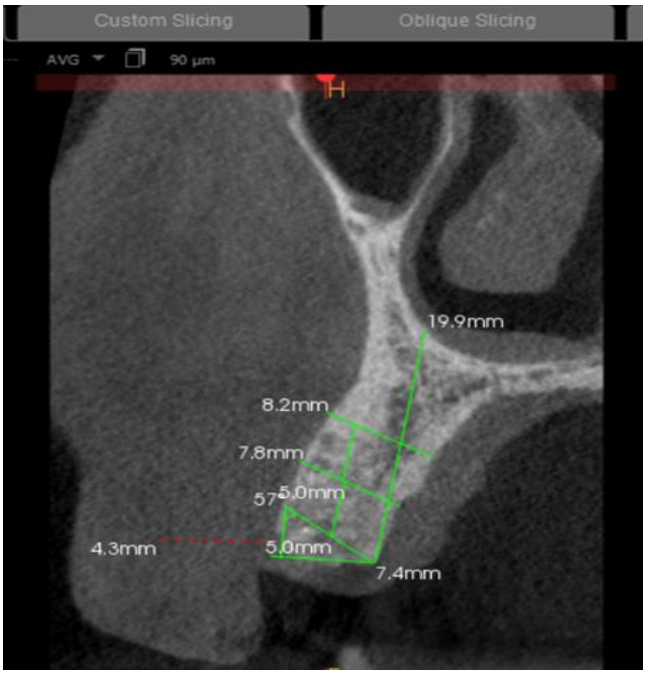


PHOTO 23:STUDY MODEL:PRE OP

PHOTO 23 A: STUDY MODEL PRE OP BUCCAL VIEW

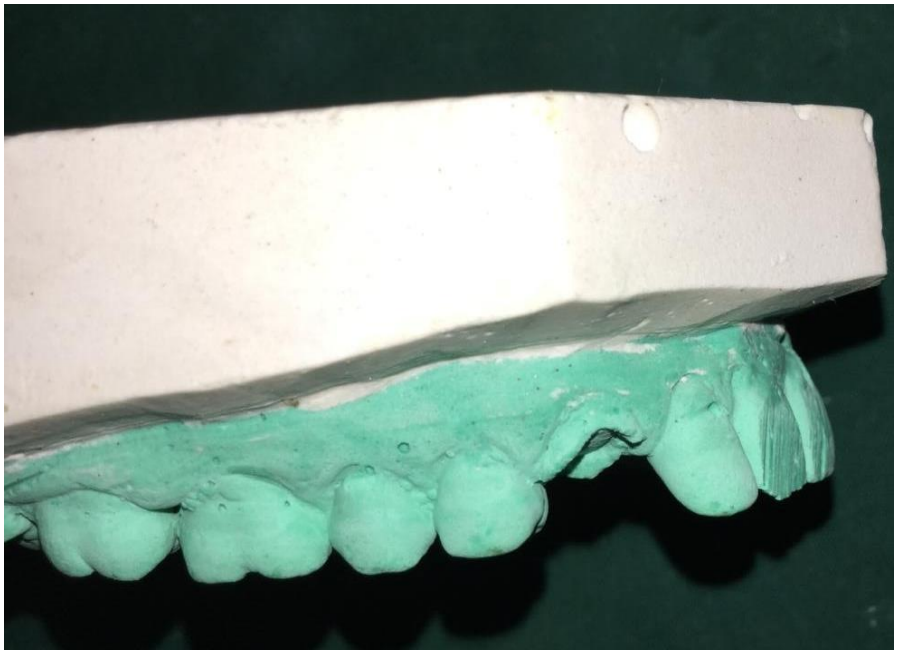


PHOTO 24: STUDY MODEL :POST OP

PHOTO 24 A:STUDY MODEL :POST OP BUCCAL VIEW

STATISTICAL ANALYSIS

The statistical analysis was done using the computer software program SPSS version 16 (IBM CORP, CHICAGO, IL, USA). Data analysis was performed using the patient as the experimental unit. For all parameters, the mean values per subject and per visit were calculated. The changes over time of these variables were examined by means of paired t test. Descriptive data are presented as mean ± SD and range values.

Statistical Tests used:

1.paired t tests were performed to compare the preoperative and postoperative values of all the variables.

2. P Value of <0.05 was considered as being statistically significant.

RESULTS

The present study was carried out with the aim to evaluate the effectiveness of autogenous dentine graft in preserving the extracted socket. All the patients who were enrolled in the study returned for scheduled maintenance visits. A total of 10 patients indicated for extraction were selected for the study. The final results and statistical analysis was done for a total of 10 sites.

10 sites were treated with minimally traumatic extraction followed by placement of autogenous dentin graft in the extracted socket area. All patients showed uneventful healing. No patient reported with any sign of infection or graft rejection. At the end of 6 months, a satisfactory clinical healing was observed in all the patients. The observations and results of various parameters are summarized in the tables and figures. Master chart observations are listed in table 2 with mean ± SD values and intragroup in table 3,4,5,6,7 respectively. Figures 2,3,4,5,6,7 diagrammatically represent clinical and radiographic parameters.

CHANGES IN CLINICAL SOFT & HARD TISSUE DIMENSIONS

The ridge width was assessed using a custom made acrylic stent and Boley's gauge. Preoperatively, the soft tissue mean ridge width was 13.51 ± 3.12mm. The ridge width at the end of 6 months was 12.5±3.09mm.

The mean difference in the soft tissue ridge width between pre-operative and post-operative analysis was 1.01±0.30mm and was found to be statistically significant with a p value of $p=0.000$ ($p < 0.05$).

RADIOLOGICAL PARAMETERS

CHANGES IN RADIOGRAPHIC (CBCT) SOCKET WIDTH

For more accurate assessment of alveolar ridge width (available bone volume), CBCT were used pre operatively and post operatively for evaluation.

In this study, the mean ridge width was assessed at different height from the crest level, as the purpose of this study was to evaluate the amount of the extracted socket preserved (ridge) following minimally traumatic extraction and autogenous dentine graft placement. Hence the mean ridge width was assessed at crest level, 5mm from the crest level and 10mm from the crest level. Pre operative assessment showed a mean ridge width at the crest level of 10.84 ± 2.9mm,11.36 ±2.66mm at 5mm from the crest level and 12.59 ± 2.24 mm at 10mm from the crest level. Post operative assessment was done at the end of 6 months which showed a mean ridge width of 9.83 ± 2.95mm at the crest level, 10.9 ± 2.62 mm at 5mm from the crest level and 11.96 ± 2.30 mm at 10mm from the crest level.

The mean difference of pre operative and post operative crest width was 1.01±0.29mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of pre operative and post operative width at 5mm from crest was 0.37±0.10mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of pre operative and post operative width at 10mm from crest was 0.63±0.20mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of alveolar socket preservation width between the preoperative and 6months post operative evaluation at the crest level , 5 mm from the

crest level and 10 mm from crest level were statistically significant with a significance value ($p < 0.05$)

CHANGES IN RADIOGRAPHIC (CBCT) SOCKET HEIGHT

Pre operative CBCT assessment showed a mean height of 15.16 ± 3.12mm. Post operative assessment was done at the end of 6 months which showed a mean height of 14.92 ± 3.13mm. The mean difference of pre operative and post operative height was 0.24±0.19mm and that was found to be statistically significant with a p value of $p=0.003(p<0.05)$.

TABLES

TABLE 2:

DESCRIPTIVE STATISTICS

	N	Minimum	Maximum	Mean		Std. Deviation
		Statistic	Statistic	Statistic	Std. Error	Statistic
CREST WIDTH PREOPERATIVE	10	7.3	15.2	10.840	.9451	2.9886
CREST WIDTH POSTOPERATIVE	10	6.5	14.3	9.830	.9354	2.9579
AT 5mm FROM CREST PREOPERATIVE	10	8.0	15.5	11.360	.8429	2.6655
AT 5mm FROM CREST POSTOPERATIVE	10	7.8	15.1	10.990	.8287	2.6206
AT 10mm FROM CREST PREOPERATIVE	10	8.9	15.9	12.590	.7091	2.2422
AT 10mm FROM CREST POSTOPERATIVE	10	8.2	15.3	11.960	.7290	2.3052
HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) PREOPERATIVE	10	10.0	19.9	15.160	.9890	3.1274
HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) POSTOPERATIVE	10	9.8	19.9	14.920	.9924	3.1382
SOFT TISSUE WIDTH PREOPERATIVE	10	9.9	18.1	13.510	.9878	3.1235
SOFT TISSUE WIDTH POSTOPERATIVE	10	9.1	17.3	12.500	.9778	3.0919

TABLE 3:

RADIOGRAPHIC PARAMETERS:

Paired T Test to compare preoperative and postoperative crest width

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
CREST WIDTH PREOPERATIVE – CREST WIDTH POSTOPERATIVE	1.0100	.2998	.0948	.7955	1.2245	10.653	9	.000*

TABLE 4:

Paired T Test to compare preoperative and postoperative at 5mm from crest

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
AT 5mm FROM CREST PREOPERATIVE – AT 5mm FROM CREST POSTOPERATIVE	.3700	.1059	.0335	.2942	.4458	11.045	9	.000*

TABLE 5:

Paired T Test to compare preoperative and postoperative at 10mm from crest

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
AT 10mm FROM CREST PREOPERATIVE – AT 10mm FROM CREST POSTOPERATIVE	.6300	.2003	.0633	.4867	.7733	9.947	9	.000*

TABLE 6:

Paired T Test to compare preoperative and postoperative height (fixed anatomical landmark to crest)

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) PREOPERATIVE – HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) POSTOPERATIVE	.2400	.1897	.0600	.1043	.3757	4.000	9	.003*

TABLE 7:

Paired T Test to compare preoperative and postoperative soft tissue width

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SOFT TISSUE WIDTH PREOPERATIVE – SOFT TISSUE WIDTH POSTOPERATIVE	1.0100	.2998	.0948	.7955	1.2245	10.653	9	.000*

NOTE:

*THE DIFFERENCE BETWEEN THE PREOPERATIVE AND POSTOPERATIVE VALUES ARE STATISTICALLY SIGNIFICANT (P<0.05)

Figure 2

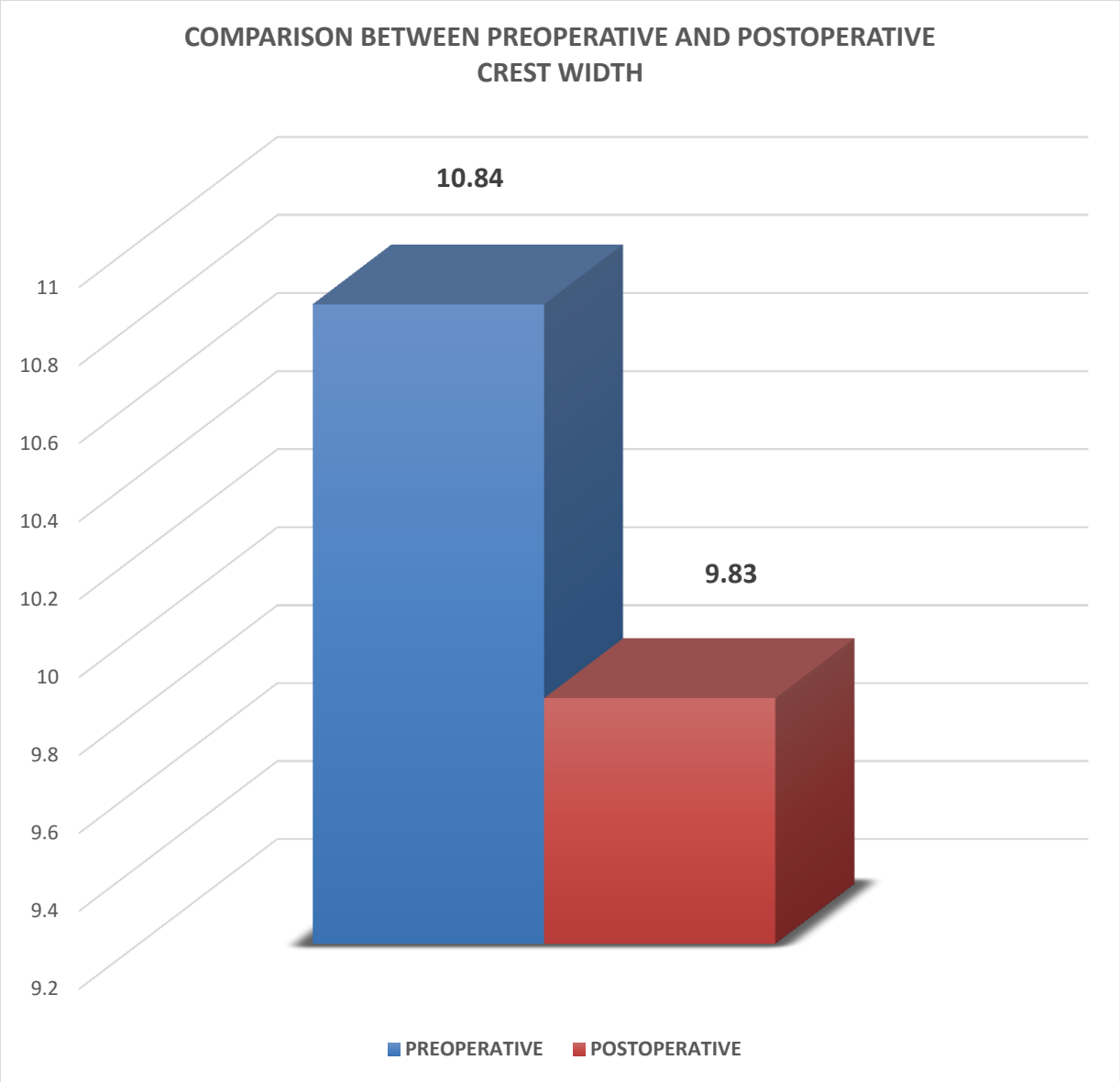

COMPARISON BETWEEN PREOPERATIVE AND POSTOPERATIVE CREST WIDTH
10.84
9.83
11
10.8
10.6
10.4
10.2
10
9.8
9.6
9.4
9.2
PREOPERATIVE
POSTOPERATIVE

Figure 3

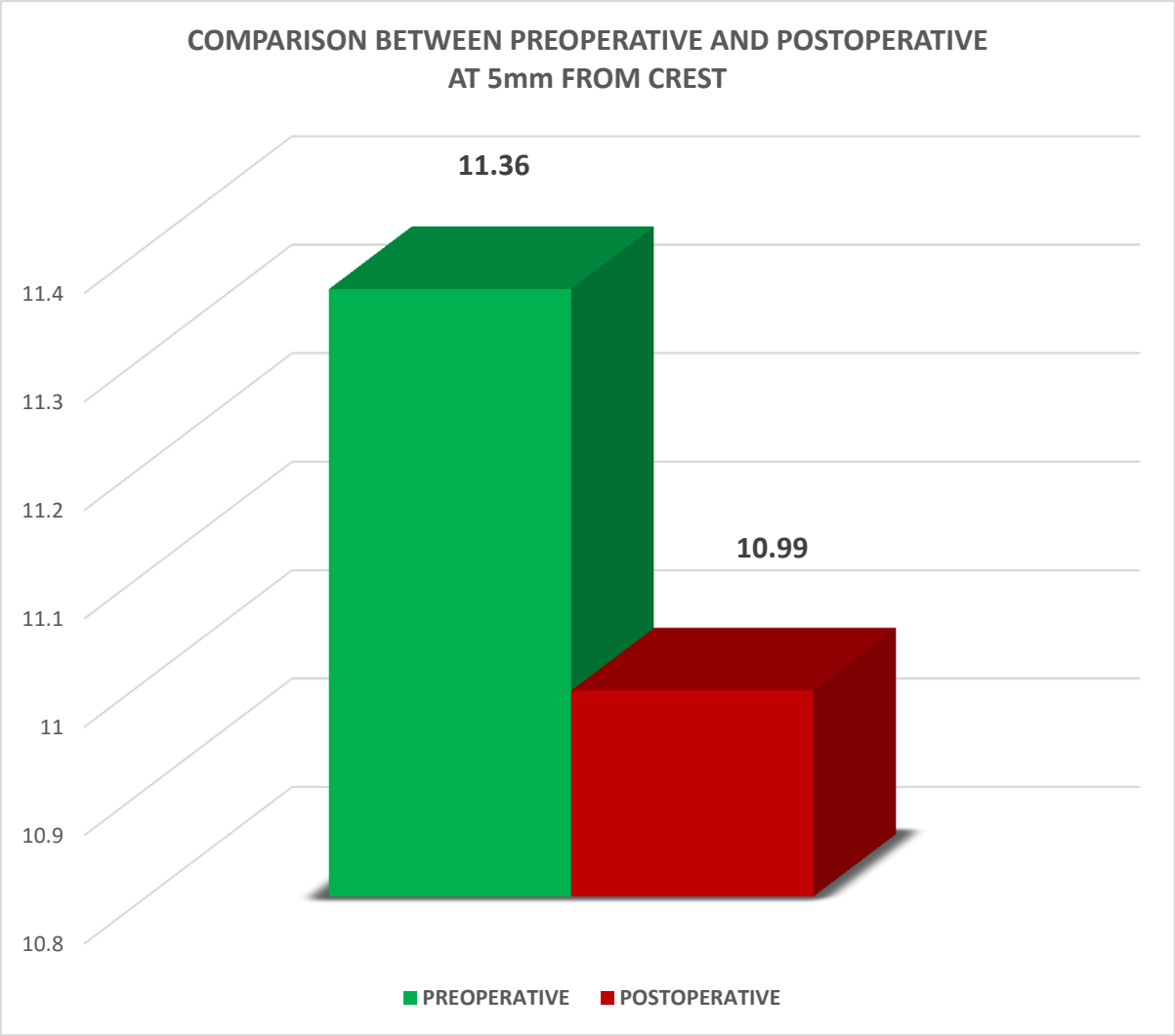

COMPARISON BETWEEN PREOPERATIVE AND POSTOPERATIVE AT 5mm FROM CREST
11.36
10.99
11.4
11.3
11.2
11.1
11
10.9
10.8
PREOPERATIVE
POSTOPERATIVE

Figure 4

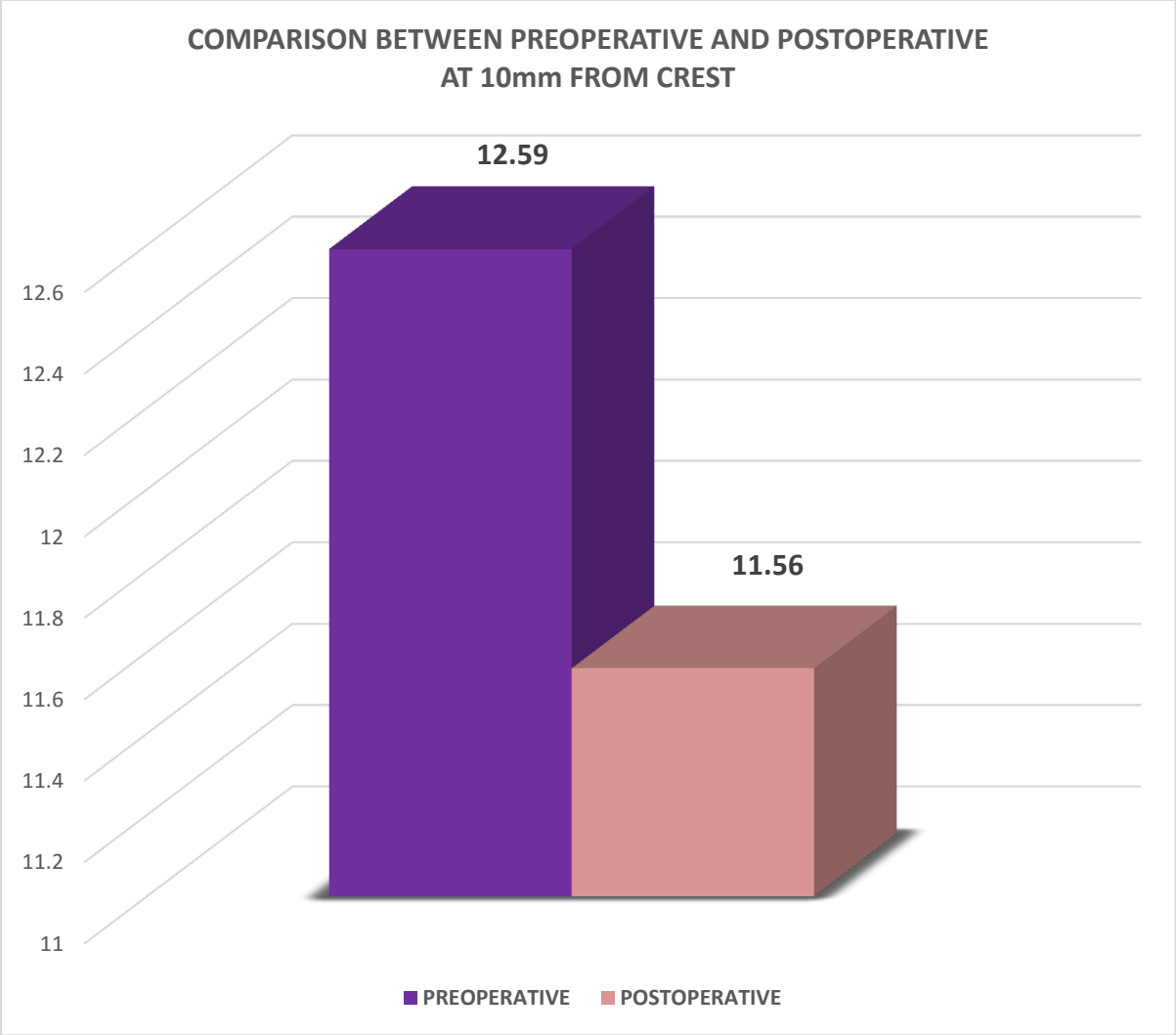

COMPARISON BETWEEN PREOPERATIVE AND POSTOPERATIVE AT 10mm FROM CREST
12.59
11.56
12.6
12.4
12.2
12
11.8
11.6
11.4
11.2
11
PREOPERATIVE
POSTOPERATIVE

Figure 5

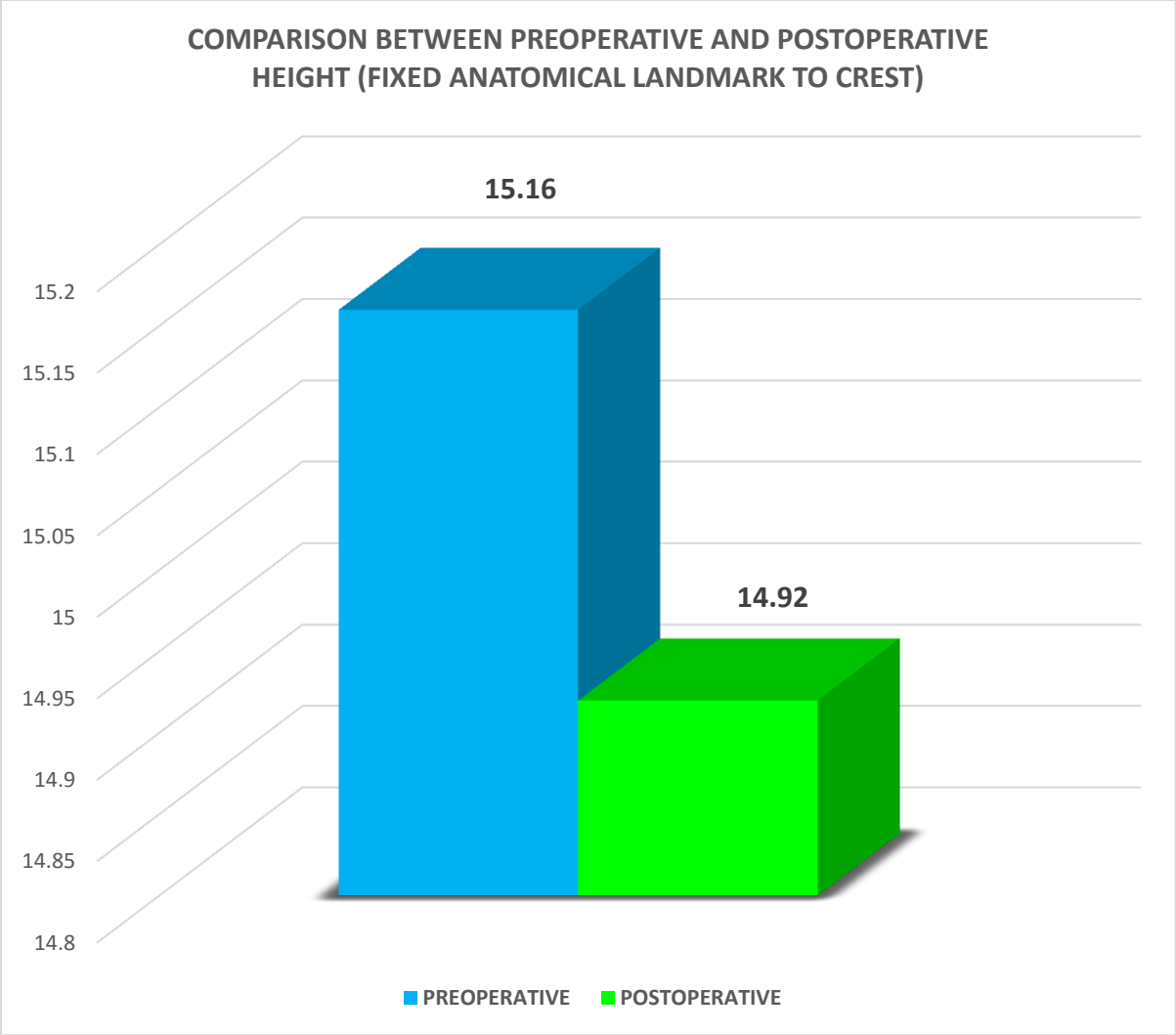

COMPARISON BETWEEN PREOPERATIVE AND POSTOPERATIVE HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST)
15.16
14.92
15.2
15.15
15.1
15.05
15
14.95
14.9
14.85
14.8
PREOPERATIVE
POSTOPERATIVE

Figure 6

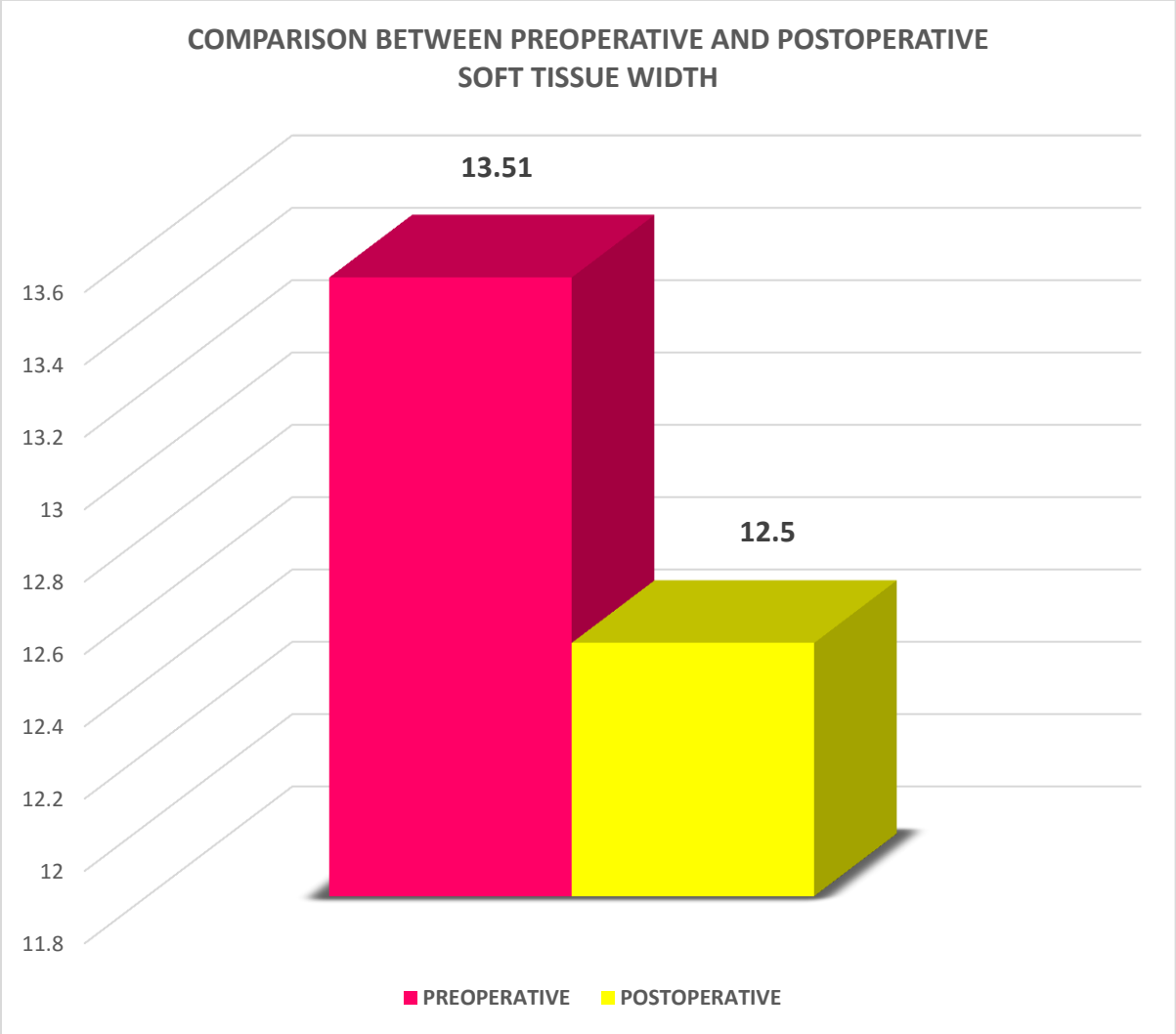
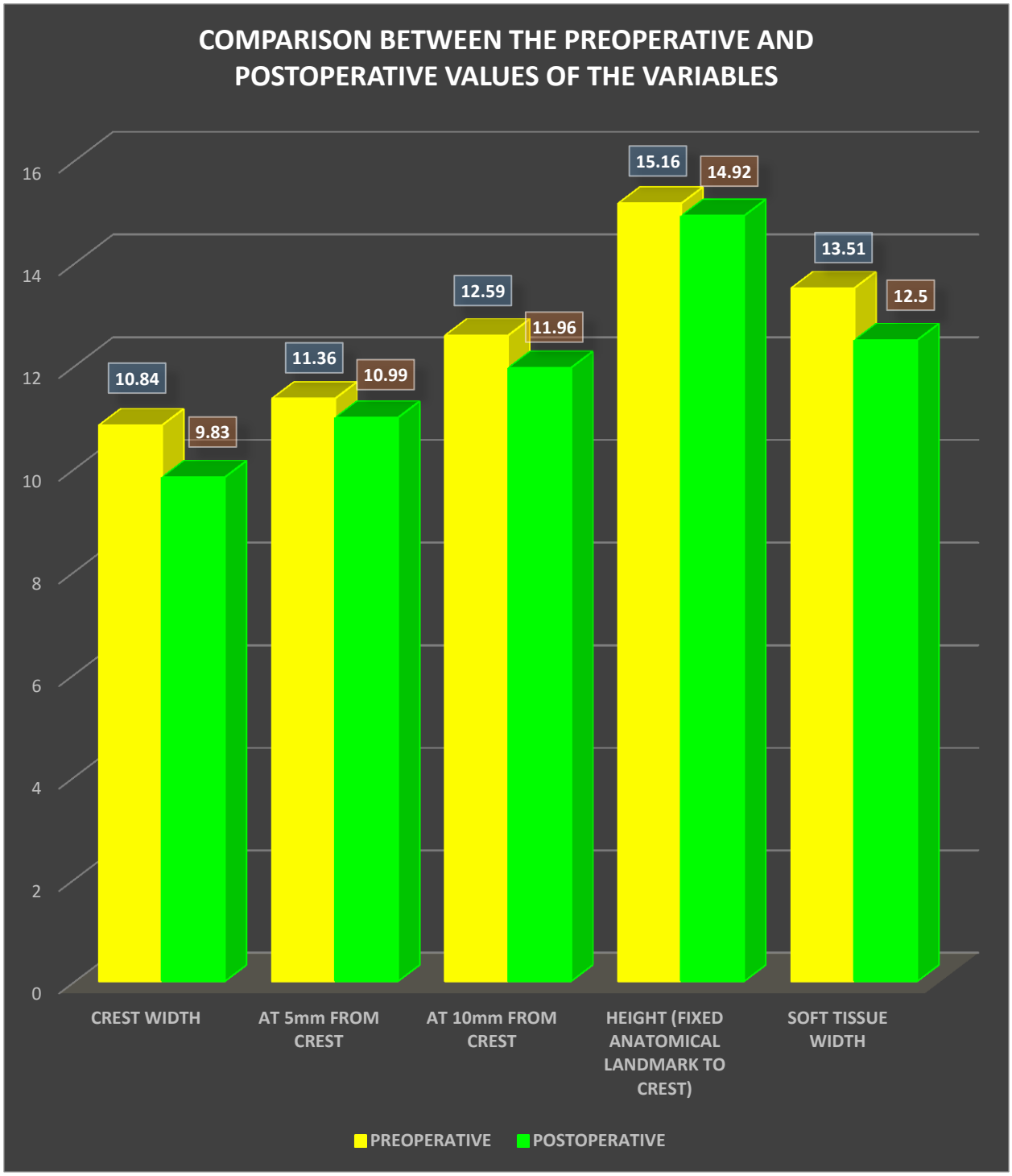

COMPARISON BETWEEN PREOPERATIVE AND POSTOPERATIVE SOFT TISSUE WIDTH
13.51
12.5
13.6
13.4
13.2
13
12.8
12.6
12.4
12.2
12
11.8
PREOPERATIVE
POSTOPERATIVE

Figure 7


COMPARISON BETWEEN THE PREOPERATIVE AND POSTOPERATIVE VALUES OF THE VARIABLES
16
14
12
10
8
6
4
2
0
10.84
9.83
11.36
10.99
12.59
11.96
15.16
14.92
13.51
12.5
CREST WIDTH
AT 5mm FROM CREST
AT 10mm FROM CREST
HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST)
SOFT TISSUE WIDTH
PREOPERATIVE
POSTOPERATIVE

DISCUSSION

Loss of alveolar bone may be attributed to a variety of factors, such as endodontic pathology, periodontitis, facial trauma and aggressive maneuvers during extractions. Millions of teeth are extracted annually with most extractions done with no regard for maintaining the alveolar ridge **Mecall RA et al..1991.**[102]

Whether due to caries, trauma or advanced periodontal disease, tooth extraction and subsequent healing of the socket commonly result in osseous deformities of the alveolar ridge, including reduced height and reduced width of the residual ridge. The severity of the healing pattern may pose a problem for the clinician in the fabrication of an implant-supported restoration or a conventional prosthesis.

However, it is possible to minimize such problems by simply carrying out ridge preservation procedures in extraction sockets using grafting materials with or without barrier membranes. Several studies, clinical case series and literature reviews in peer-reviewed journals were examined in detail to establish a rationale for using socket preservation as a therapeutic option following tooth extraction.

Tooth extraction is invariably followed by loss of height and width of the alveolar process. During natural healing after extraction, reductions in width of between 2.6 and 4.6 mm and in height of between 0.4 and 3.9 mm are observed BY **Ten Heggeler JMAG, 2011**, **Pinho MN et al.. 2006**[4] in the same study stated that it resulted in narrowing and shortening of the residual ridge. Therefore, various methods were attempted to minimize alveolar bone resorption. Different types of bone substitutes such as demineralized freeze-dried bone allograft (DFDBA), bioglass, and/or hydroxyapatite were used either with resorbable or nonresorbable membrane. Many scholars introduced

their unique ridge preservation techniques to maximize the alveolar ridge preservation result. Platelet-rich plasma, resorbable barrier membrane, acellular dermal matrix, collagen sponge, or calcium sulfate was mixed with a bone graft material for more favorable results.

The advantages of using autogenous bone include its increased capacity for bone formation, osteoconduction, and osteoinduction. It does not induce immunologic reaction or rejection, and it heals rapidly. But the biggest shortcomings are that the harvest amount is limited and that harvesting bone induces a secondary defect.

Extracted tooth which has so far occupied space only in bio medical waste has now been started to process and replace commercial bone graft material. Autogenous tooth bone graft material is safer than graft materials from allogeneic or xenogeneic teeth because the autogenous material comes from the patient's own body eliminating immunogenic reactions. In addition, autogenous tooth graft material contains both inorganic and organic substances, promotes better bone healing, and exhibits excellent osteoinduction and osteoconduction properties. In histological tests, healing adjacent to autologous bone grafts has been observed; thus confirming the safety of autogenous tooth bone graft material. **Kim 2011**[5]

Park[64] and coworkers reported that there were no infections in 250 patients who received autotooth bone grafts with GBR, sinus grafts, socket preservation and ridge augmentation from Sep. 2009 to Dec. 201116).

Tazaki and coworkers performed an immediate DDM graft around a transplated tooth. The dental X-ray showed periodontal space and lamina dura at 12 months after the operation. They suggested that the preserved autogenous DDM could be used as collagenous biomaterials with osteoinductive potency. According to the retrospective

cohort study from 2008 to 2009, 37 patients who received sinus bone graft, ridge augmentation and GBR with powder showed minimal to no post-operative complications during 2-year follow up.

The teeth selected for the study were vital nonrestorable tooth without endodontic treatment. The pulp, enamel and cementum were removed. The remaining dentine structure is grinded down to a particle size of 300 μm to 1200 μm. The dentine particle are then sterilized and partially decalcified with organic acid 1N lactic acid for 15 to 20 mins and cleansed with normal saline for 60seconds to remove any residual acid. The above procedures can be done by chair side and the whole process takes around 15 to 25mins.

Here in the present study the effectiveness of autogenous dentine graft in preservation of extracted alveolar socket dimension is analysed clinically and radiographyically at baseline and 6 months . 10 sites were treated with minimally traumatic extraction followed by placement of autogenous dentin graft in the extracted socket area. All patients showed uneventful healing. No patient reported with any sign of infection or graft rejection. At the end of 6 months, a satisfactory clinical healing was observed in all the patients.

CBCT scans were taken on the day of extraction immediately after grafting procedure and after 6 months post treatment. CBCT scan being three dimensional in nature has helped us to evaluate changes in alveolar bone in all possible dimensions and measure them precisely. CBCT method is useful in assessing images three- dimensionally with the advantage of high accuracy, high resolution, and low cost as compared to CT **Misch KA, 2006.**

Preoperatively, the soft tissue mean ridge width was 13.51 ± 3.12mm. The ridge width at the end of 6 months was 12.5±3.09mm. The mean difference in the soft tissue ridge width between pre-operative and post-operative analysis was 1.01±0.30mm and was found to be statistically significant .

Pre operative assessment showed a mean ridge width at the crest level of 10.84 ± 2.9mm,11.36 ±2.66mm at 5mm from the crest level and 12.59 ± 2.24 mm at 10mm from the crest level.

Post operative assessment was done at the end of 6 months which showed a mean ridge width of 9.83 ± 2.95mm at the crest level, 10.9 ± 2.62 mm at 5mm from the crest level and 11.96 ± 2.30 mm at 10mm from the crest level.

The mean difference of pre operative and post operative crest width was 1.01±0.29mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of pre operative and post operative width at 5mm from crest was 0.37±0.10mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of pre operative and post operative width at 10mm from crest was 0.63±0.20mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

The mean difference of alveolar socket preservation width between the preoperative and 6months post operative evaluation at the crest level , 5 mm from the crest level and 10 mm from crest level were statistically significant with a significance value ($p <0.05$)

Pre operative CBCT assessment showed a mean height of 15.16 ± 3.12mm. Post operative assessment was done at the end of 6 months which showed a mean height of 14.92 ± 3.13mm. The mean difference of pre operative and post operative height was 0.24±0.19mm and that was found to be statistically significant with a p value of p=0.003. These results were in accordance to the study done by **Chaitanya Pradeep Joshi et al 2016.**[99]

In the present study autogenous dentine graft showed significant result in clinical and radiographic parameters in the preservation of extracted alveolar socket. However re-entry and histological evaluation remains the Gold standard measure to evident bone formation. Further investigations need to be done with large number of patients over long period of time and histological investigations .

SUMMARY AND CONCLUSION

The aim of the study was to evaluate the effectiveness of autogenous dentine graft prepared at chairside immediately after extraction as a material in the preservation of extracted socket dimension. A total of 10 sites were selected for the study. The level of soft and hard tissue were measured at baseline, six months post operatively and analyzed statistically.

From the results of this study, the following conclusions could be drawn:

1.The study is able to validate the need of socket preservation immedietly after extraction in maintaining height and width of the alveolar ridge which aids in for perfect replacement of the subsequent edentulous area with either fixed prosthesis or implant.

2. Rather than disposing extracted teeth as biomedical waste, they can be used as an autogenous graft material and serve as a better alternative to most of the conventional graft materials

3. It has been clearly established radiographically as well as clinically,that socket preservation using autogenous dentine graft results in good bone fill as well as minimize the residual ridge resorbtion in terms of socket height and width.

4. Being autogenous dentine graft it eliminates antigenic reaction.

5. Autogenous dentine graft harvested from the same individual for socket preservation reduces the cost and prevents the usage of commercially avilable bone graft material

.

6.Since the autogenous graft is being produced chair side ,it eliminates the second surgical intervention which was previously possible only by sending the tooth to the commercially avaiable tooth banks around the world (AUTO BT korea)

Within the limits of present study, socket preservation using autogenous dentine graft offers many advantages for patients and the clinicians. However, careful patient selection and treatment planning appears to be of critical importance in achieving a predictable outcome. Further randomized clinical trials are needed to moniter soft tissue dynamics , hard tissue changes and histological observations required to establish its regenerative potential in various field of applications.

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PARTICIPANT INFORMATION SHEET

Investigator : DR.RAJSUNDAR .T

Guide : DR.MAHEASWARI RAJENDRAN, MDS

Title : **EVALUATION OF CLINICAL EFFECTIVENESS OF AUTOGENOUS DENTIN GRAFT IN SOCKET PRESERVATION – A CLINICAL AND RADIOGRAPHICAL STUDY**

Name of the research institution : Tamilnadu Government Dental College and Hospital, Chennai

The investigator, Dr. RAJSUNDAR .T under the guidance of Dr. MAHEASWARI RAJENDRAN, MDS is conducting a study as titled above with aim to do an evaluation of alveolar socket preservation using autogenous tooth bone graft material – a clinical0020study.

1. **Procedure : the following examinations and investigations will be done for you.**
    - Intraoral examination, Extraoral examination
    - Blood test – 7ml of blood will be drawn from your hand
    - X-ray will be taken with protection (lead apron , thyroid collars)
    - Model of your teeth will be prepared by taking alginate impression
    - Deposits on your teeth will be cleaned with ultrasonic scaler and hand instrument. Surgery will be done with placement of intended material in the diseased site
    - Clinical and radiological evaluation will be performed at baseline , 3 months and 6 months after the procedure.
2. **Risk of participation:**
    - Patients may be allergic to LA(local anesthesia) or the material used in the study.
    - Patient may experience pain, discomfort, swelling following the procedure.
3. **Benefits of participation:**

    Patients will be treated for maintaining the alveolar ridge dimension and minimizing alveolar bone loss.

4. **Confidentiality :**

   The identity of the patients participating in the research will be kept confidential throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

5. **Participants right :**

   Taking part in the study is voluntary. You are free to decide whether to participate in the study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled. The results of this study will be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

6. **Compensation: Nil**

7. **Contacts:**

For queries related to the study:	**Contact details regarding rights of the participant:**
Primary Investigator: Dr.Rajsundar .T PG Student Department of Periodontics Tamilnadu Govt. Dental College & Hospital Chennai- 600 003 Mobile – 9498069110	Dr. B. Saravanan, MDS,PhD, The Chairperson, Institutional Ethical committee Tamilnadu Govt. Dental College & Hospital, Chennai-600 003.

ANNEXURE - 2

ஆராய்ச்சி பற்றிய தகவல் படிவம்

ஆராய்ச்சி மேற்கொள்பவர்: **வழிநடத்துபவர்:**

மருத்துவர்.த.ராஜ்சுந்தர் **மருத்தவர்.மகேஷ்வரி இராஜேந்திரன்**

ஆராய்ச்சி நிறுவனத்தின் பெயர்: தமிழ்நாடு அரசு பல் மருத்துவக் கல்லூரி மற்றும் மருத்துவமனை.

ஆராய்ச்சியின் தலைப்பு:

"பற்குழிவு பாதுகாப்பிற்காக பல்திசு ஒட்டு பயன்படுத்தும் மருத்துவ மற்றும் கதிரியக்க ஆய்வு"

ஆராய்ச்சியின் நோக்கம்:

பற்குழிவு பாதுகாப்பிற்காக பல்திசு ஒட்டு பயன்படுத்தி மருத்துவ மற்றும் கதிரியக்க மதிப்பீடுகளை அறுவை சிகிச்சைக்கு முன் மற்றும் ஆறு மாதங்களுக்குப் பின் ஆய்வு செய்தல்.

செய்முறை:

கீழ்கண்ட ஆய்வுகள்/பரிசோதனைகள் உங்களுக்கு செய்யப்படும்:

- வாய் பரிசோதனை - உட்புறம், வெளிப்பறம்.
- நோயுற்ற பகுதியின் ஊடுகதிர்படம் எடுக்கப்படும்.
- வழக்கமான இரத்தப்பரிசோதனை செய்யப்படும்.
- உங்கள் கையிலிருந்து பரிசோதனைக்காக 5மிலி அளவு (ஒரு மேஜைக் கரண்டி அளவு) இரத்தம் எடுக்கப்படும்.
- சிகிச்சை தேவைப்படும் பல்லின் அளவானது ஆல்ஜினேட் அச்சு கொண்டு எடுக்கப்படும்.
- ஒவ்வாமை ஏற்படுகிறதா என்பதை தெரிந்துகொள்ள 0.5மிலி 2% லிக்னோகெயின் என்னும் மரத்துப்போக செய்யும் மருந்து உங்களின் கையில் பரிசோதனைக்காக செலுத்தப்படும். பின்பு நோயுற்ற பகுதியில் இம்மருந்து செலுத்தப்படும்.
- அல்ட்ரா சோனிக் ஸ்கேலர் மற்றும் கைக்கருவிகள் பயன்படுத்தி பல் மற்றும் பல்லின் வேர் சுத்தம் செய்யப்படும். உப்புநீர் கொண்டு நோயுற்ற பகுதி சுத்தம் செய்யப்படும்.
- மோசமான முன்னறிவித்தலை கொண்ட பல் எடுக்கப்படும். எடுக்கப்பட்ட பல்லின் குழிவை பாதுகாக்க பின்பு தங்களின் பல்திசு ஒட்டாக பயன்படுத்தப்படும்.
- மருத்துவ மற்றும் கதிரியக்க மதிப்பீடு தொடக்க நிலை மற்றும் ஆறு மாதங்களுக்குப் பின் செய்யப்படும்.

<u>பங்கேற்பதினால் வரக்கூடிய பக்கவிளைவுகள்:</u>

- ஊடுகதிர் படம் எடுக்கும் பொழுது கதிர்வீச்சினால் பாதிப்பு ஏற்பட வாய்ப்பு உள்ளது.
- சிகிச்சைக்குப்பின் வலி ஏற்பட வாய்ப்பு உள்ளது.

<u>பக்க விளைவுகள் ஏற்படாமல் தடுக்க உரிய முறைகள் பின்பற்றப்படும்:</u>

- ஊடுகதிர் படம் எடுக்கப்படும் பொழுது உரிய பாதுகாப்பு உபகரணங்கள் பயன்படுத்தப்படும்.
- சிறந்த தரம் மற்றும் சுத்தமான கருவிகள் பயன்படுத்தப்படும்.
- சிகிச்சைக்குப்பின் வலி அல்லது வீக்கம் ஏற்பட்டால் தேவையான மருந்துகளும் மருத்துவமும் வழங்கப்படும்.

பங்கேற்பதினால் விளையும் நன்மைகள்:

மோசமான முன்னறிவித்தல் கொண்ட பல் எடுக்கப்பட்டு அந்த பற்குழி தங்களின் பல்திசு ஒட்டு கொண்டே பாதுகாக்கப்படும்.

இரகசியகாப்பு:

உங்களை பற்றிய குறிப்புகள் பிறர் அறியாவண்ணம் ஆராய்ச்சி முடியும்வரை இரகசியமாக பாதுகாக்கப்படும். அதை வெளிப்படுத்தும் நேரங்களிள் எந்த தனிநபர் அடையாளங்களும் வெளிப்பட வாய்ப்பு கிடையாது.

தன்னார்வபங்கேற்பு:

இந்த ஆராய்ச்சியில் பங்கு பெறுவது தங்களின் தனிப்பட்ட முடிவு மற்றும் இந்த ஆராய்ச்சியிலிருந்து தாங்கள் எப்பொழுது வேண்டுமானாலும் விலகிக்கொள்ளலாம். தங்களின் இந்த திடீர் முடிவு தங்களுக்கோ அல்லது ஆராய்ச்சியாளருக்கோ எவ்வித பாதிப்பும் ஏற்படுத்தாது என்பதை தெரிவித்துக்கொள்கிறோம்.

_____ _____

நோயாளியின் பெயர் நோயாளியின் கையொப்பம்

_____

ஆராய்ச்சி தொடர்புடைய தகவல்களுக்கு:
மருத்துவர்.த.ராஜ்சுந்தர்,
முதுகலை மாணவர்,

தமிழ்நாடு அரசு பல் மருத்துவமனை

மற்றும் கல்லூரி, சென்னை-600003.

பங்கேற்பாளரின் உரிமை தொடர்புடைய தகவல்களுக்கு:
மருத்துவர்.பி.சரவணனன்,
தலைவர், நிறுவன நெறிமுறைகள் குழு,

தமிழ்நாடு அரசு பல் மருத்துவமனை

மற்றும் கல்லூரி, சென்னை-600003.

ANNEXURE - 4

ஆராய்ச்சிஒப்புதல்படிவம்

ஆராய்ச்சிதலைப்பு:

"பற்குழிவு பாதுகாப்பிற்காக பல்திசு ஒட்டு பயன்படுத்தும் மருத்துவ மற்றும் கதிரியக்க ஆய்வு"

பெயர்:	வயது/பால்:
முகவரி:	தொலைபேசி:
புறநோயாளி எண்:	ஆராய்ச்சி சேர்க்கை எண்:

நான் _____ வயது _____ என்னுடைய சுயநினைவுடனும் மற்றும் முழு சுதந்திரத்திரத்துடனும் இந்த மருத்துவ ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள ஒப்புதல் அளிக்கிறேன்.

கீழ்காணப்படும் நிபந்தனைகளுக்கு நான் சம்மதிக்கிறேன்:

நான் இந்த ஆராய்ச்சியின் நோக்கம் மற்றும் செய்முறைகள் பற்றி முழுமையாக தெரிவிக்கப்பட்டுள்ளேன்.

நான் இந்த ஆய்வுக்காக ஈறு அறுவை சிகிச்சை மற்றும் பல் எடுக்கும் சிகிச்சைகளை செய்துகொள்ள வேண்டியதாக அறிகிறேன்.

சிகிச்சையின்போது பல்திசு ஒட்டு பயன்படுத்த சம்மதிக்கிறேன்.

என் உடல்நலம் பாதிக்கப்பட்டாலோ அல்லது எதிர்பாராத வழகத்திற்குமாறான நோய்குறிகள் தென்பட்டாலோ அதற்கு சிகிச்சை பெற்று கொள்வதற்கும் முழு உரிமை உள்ளதாக அறிகிறேன்.

நான் எற்கனவே உட்கொண்ட மற்றம் உட்கொள்கின்ற மருந்துகளின் விபரங்களை ஆராய்சியாளரிடம் தெரிவித்துள்ளேன்.

என் மருத்துவகுறிப்பேடுகளை இந்தஆராய்ச்சியில் பயன்படுத்திக்கொள்ள சம்மதிக்கிறேன்.

இந்ந ஆராய்ச்சி மையமும் ஆராய்ச்சியாளரும் என்னுடைய விபரங்கள் அனைத்தயும் இரகசியமாகவைப்பதாக அறிகிறேன்.

_____	_____	_____
நோயாளியின்பெயர்	கையொப்பம்	தேதி
_____	_____	_____
ஆராய்ச்சியாளரின்பெயர்	கையொப்பம்	தேதி

ANNEXURE -3

INFORMED CONSENT FORM

EVALUATION OF CLINICAL EFFECTIVENESS OF AUTOGENOUS DENTIN GRAFT IN SOCKET PRESERVATION – A CLINICAL AND RADIOGRAPHICAL STUDY

Participant ID No:

"I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way it affecting my further medical care."

_____	_____	_____
Date	Name of the participant	Signature/thumb impression Of the participant

[The literate witness selected by the participant must sign the informed consent form. The witness should not have any relationship with the research team; If the participant doesn't want to disclose his / her participation details to others, in view of respecting the wishes of the participant, he / she can be allowed to waive from the witness procedure (This is applicable to literate participant ONLY). This should be documented by the study staff by getting signature from the prospective participant]

"I have witnessed the accurate reading of the consent form to the potential participant and the individual has had opportunity to ask questions. I confirm that the individual has given consent freely"

_____	_____	_____
Date	Name of the witness	Signature of the witness
_____	_____	_____
Date	Name of the interviewer	Signature of the interviewer

ANNEXURE-5

TAMILNADU GOVERNMENT DENTAL COLLEGE&HOSPITAL, DEPARTMENT OF PERIODONTICS,

EVALUATION OF CLINICAL EFFECTIVENESS OF AUTOGENOUS DENTIN GRAFT IN SOCKET PRESERVATION – A CLINICAL AND RADIOGRAPHICAL STUDY

PROFORMA FOR TREATMENT GROUP

Date : OP No.: S.No.:

Name : Age : Sex:

Occupation : Income :

Address : Phone Number :

CHIEF COMPLAINTS AND DURATION:

HISTORY OF PRESENT ILLNESS:

PAST MEDICAL HISTORY:

PAST DENTAL HISTORY:

PERSONAL HISTORY :

a) Oral Hygiene Practices :

b) Habits :

c) Menstrual History :

GENERAL EXAMINATION

a) Extra-Oral Examination

b) Examination of Lymphnodes

INTRA-ORAL EXAMINATION WITH CLINICAL FINDINGS:

Buccal mucosa:

Vestibule:

Hard palate:

Soft palate:

Tonsils:

Tongue:

Floor of the mouth:

Teeth:

Decayed

Missing

Filled teeth

INVESTIGATIONS:

1. Biochemical / Haematological Investigation :

2. Others :

   Blood Pressure :

   Test Dose for L.A:

RADIOGRAPHIC EVALUATION

Coned beam computer tomography(CBCT)

DIAGNOSIS

PROGNOSIS

TREATMENT

1. EMERGENCY / PRELIMINARY:

2. PHASE I:

3. RE-EVALUATION AFTER PHASE I THERAPY:

4. CLINICAL SITE SELECTED FOR STUDY:

5. PHASE II: (SURGICAL)

6. PHASE III:

7. PHASE IV :(RE-EVALUATION)

CLINICAL EVALUATION

Duration	Soft tissue width
Base line	
6months	

RADIOGRAPHIC EVALUATION

Coned beam computer tomography(CBCT)

Ridge width at crest

Duration	Width at crest
Base line	
6months	

Ridge width at 5mm from crest

Duration	Ridge width at 5mm form crest
Base line	
6months	

Ridge width at 10mm from crest

Duration	Ridge width at 10mm form crest
Base line	
6months	

Socket height :

Duration	Socket height
Base line	
6months	

INFERENCE/RESULT:

SIGNATURE OF THE P.G. STUDENT

SIGNATURE OF THE GUIDE